27TH ANNUAL STATISTICAL ISSUE

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MARCH 15, 1945

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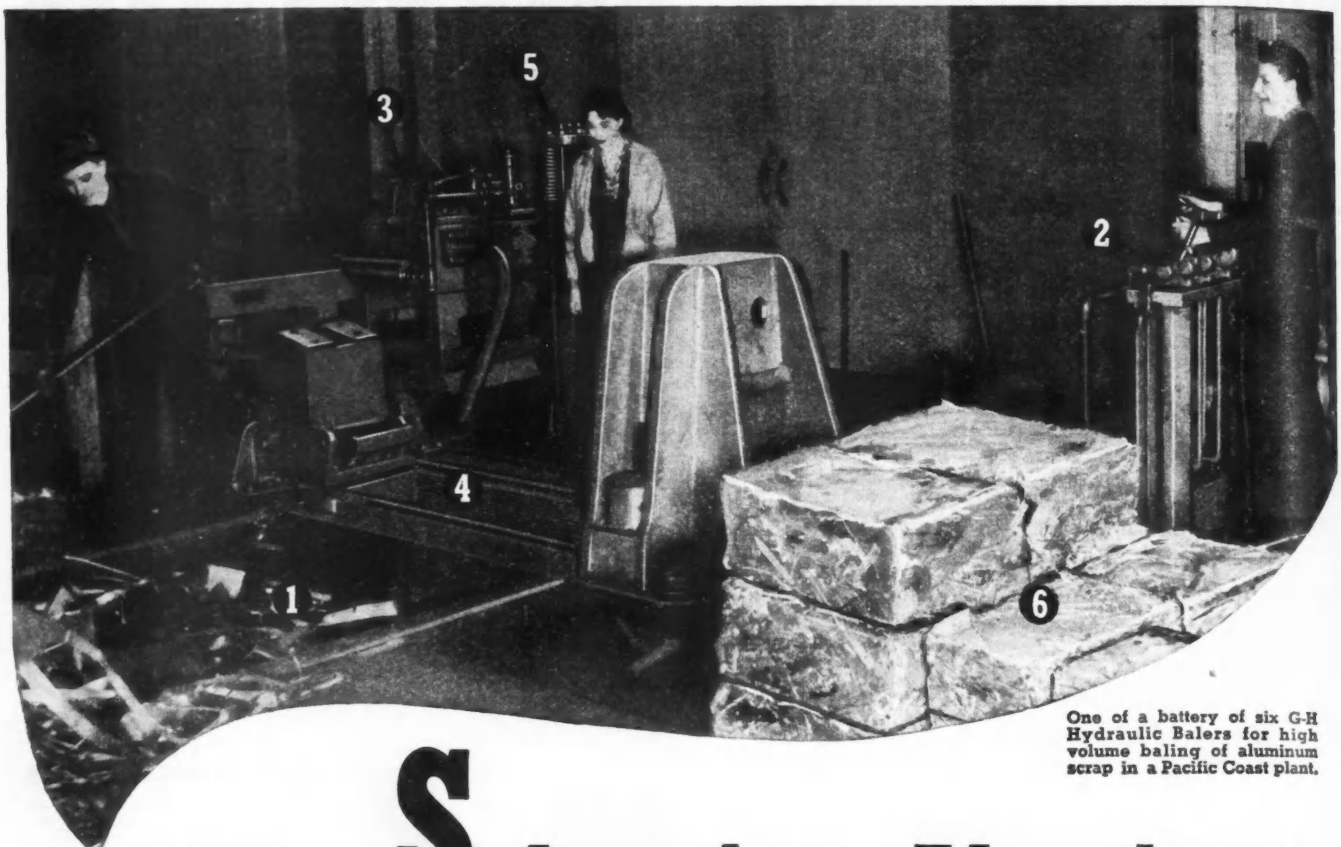

One of a battery of six G-H Hydraulic Balers for high volume baling of aluminum scrap in a Pacific Coast plant.

Salvaging Aluminum Sheet Scrap *Speeds Aircraft Production*

KEY TO ILLUSTRATION

1 Loading Hopper into which loose scrap is gathered.

2 Easily operated control valves manipulated by woman employee.

3 Poppet type hydraulic operating valves provide dependable distribution of power.

4 Baling chamber where loose scrap is converted to dense mill size bales.

5 Shock Alleviator protects hydraulic system.

6 Finished Bales, loaded on skids.

To meet the ravenous wartime demands of that new giant, the aircraft industry, it is necessary that the aluminum mills receive a constant flow of usable scrap . . . in order to operate at top capacity.

Many Aluminum Sheet Mills, as well as Aircraft plants, are equipped with Galland-Henning Hydraulic Baling Presses to convert loose trimmings and scrap into dense, compact bales suitable for charging the resmelting furnaces.

G-H Balers for quick, low-cost baling of ferrous and non-ferrous scrap are available in both pit and floor type models, in capacities from ¼ ton to 10 tons per hour or more. Write for literature.

GALLAND-HENNING MFG. CO., 2747 S. 31st St., Milwaukee 7, Wis.

GALLAND-HENNING

SCRAP METAL BALING PRESSES

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AUTOMOTIVE and AVIATION INDUSTRIES

Published on the 1st and 15th of the month

March 15, 1945
Volume 92, No. 6

IN THIS ISSUE

COST OF GLOBAL WARFARE

GENERAL INDUSTRIAL

LEND-LEASE

AUTOMOTIVE

AUTOMOTIVE, *Continued*

AVIATION STATISTICS

SPECIFICATIONS

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

NE Alloys Standardized by Institute

Wide Range of Sizes in Ryerson Stocks

Because large tonnages of the NE 8600 and NE 8700 series of alloy steels have been used successfully for a wide range of applications and have shown excellent mechanical properties and desirable response to both fabrication and heat treatment, the American Iron and Steel Institute now registers these as standard AISI alloy steels. The AISI prefix will replace the NE designation but the numbers will remain the same.

Ryerson selected the 8600 and 8700 series alloys at the start of the NE (National Emergency Alloy) program. Large stocks have been built up and a full range of sizes are available for quick delivery from Ryerson stock.

On all Ryerson alloys you get this plus service: With each shipment of alloy steel, you receive a report, which includes chemical analysis, grain size, working temperatures, Jominy Hardenability Test results, and physical properties interpreted from hardenability for various sized rounds quenched and tempered at three different draw temperatures. The report pertains specifically to the heat of alloy delivered. All bars are identified according to heat, with painted color markings and stamped heat symbols, which correspond to the identification noted on the report.

Thus Ryerson offers uniform, high quality, *plus* complete working information that enables you to heat treat correctly without further testing or re-testing. Call Ryerson for 8600 and 8700 and all other alloys as well as carbon and stainless steel products.

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC., STEEL-SERVICE PLANTS: CHICAGO, MILWAUKEE, DETROIT, ST. LOUIS, CINCINNATI, CLEVELAND, PITTSBURGH, PHILADELPHIA, BUFFALO, NEW YORK, BOSTON

1945
STATISTICAL ISSUE

AUTOMOTIVE and AVIATION INDUSTRIES

THIS is the 27th Statistical Issue to be published. World War I had ended but a few months before the first of this long and uninterrupted series of annual reference numbers appeared. Civilian production during that war was not seriously affected. Concerning such things as post-war planning little needed to be done. Today, the automotive and aviation industries which this publication serves are fully engaged in production for war. But another day is coming. It is too early for the definite planning of reconversion of production facilities but it is not too early to consider the character and extent of the market in a happier tomorrow. For that reason, data relating thereto, which have been omitted from the two immediately preceding Statistical Issues, are included here in addition to a record of our industries' production accomplishment and statistical material and specifications that are useful to and needed by these industries for their work today and for their guidance in looking ahead and planning the work to be done and the demand to be met in the days to come.

SELECTED ITEMS FROM
INDUSTRY'S WAR PRODUCTION RECORD
JULY 1, 1940, TO DECEMBER 31, 1944

MILITARY AIRPLANES, number	253,270
ARMORED CARS, number	14,767
HEAVY TRUCKS, 2½ tons and over, number	769,468
NAVY SHIPS, displacement tons	6,871,000
TANKS, all types, number	75,204
TANK AND S. P. GUNS, number	130,017
ARTILLERY, ALL FIELD, number	55,252
MORTARS, number	71,124
ANTIAIRCRAFT GUNS, ARMY, number	48,958
MACHINE GUNS, number	2,422,099
RIFLES, number	5,942,385
CARBINES, number	5,163,826
SUBMACHINE GUNS, number	1,926,405
SMALL ARMS AMMUNITION, rounds	37,198,000,000
AIRCRAFT GUN AMMUNITION, rounds	337,046,000
ARTILLERY AMMUNITION, GROUND, short tons	2,927,502
MORTAR SHELLS, rounds	73,067,000
AIRCRAFT BOMBS, short tons	4,130,000
COMMUNICATIONS AND ELECTRONICS EQUIPMENT	$9,405,000,000

COST OF

Presented here are Cost data of Global Warfare to the United States in the form of rapidly rising direct war expenditures, the increasing load of corporate taxes and the mounting Federal debt.

U. S. War Program, Expenditures and Indicated Unspent Funds

Cumulative Totals from June 30, 1940, to End of Month Specified

(Millions of Dollars)

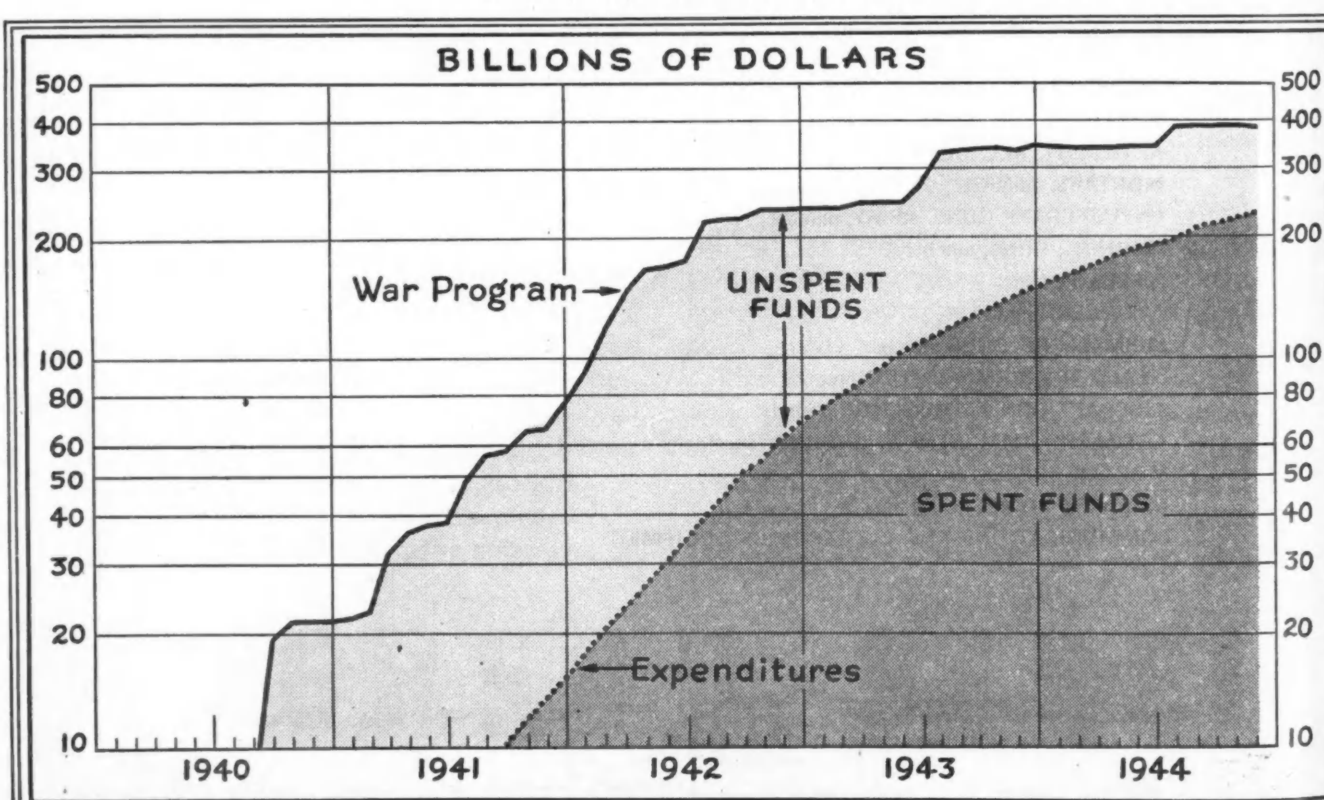
	War Program	Expenditures	Indicated Unspent Funds
December 1940	$21,355	$1,911	$19,444
March 1941	31,420	3,963	27,457
June 1941	38,084	6,655	31,429
September 1941	57,865	10,412	47,453
December 1941	77,710	15,803	61,907
March 1942	146,744	23,422	123,322
June 1942	175,599	34,921	140,678
September 1942	221,918	50,250	171,668
December 1942	237,949	68,208	169,741
March 1943	246,147	87,655	158,492
June 1943	275,753	110,005	165,748
September 1943	340,167	131,492	208,675
December 1943	344,184	153,342	190,842
1944			
January	$343,102	$160,758	$182,344
February	341,308	168,566	172,742
March	341,330	176,515	164,815
April	341,757	184,008	157,749
May	341,605	191,926	149,679
June	343,514	199,883	143,631
July	392,377	207,238	185,139
August	392,453	215,035	177,418
September	392,479	222,140	170,339
October	391,096	229,586	161,510
November	390,389	236,682	163,707
December	390.524	244.516	146,008

War program includes all funds made available for war purposes by the U. S. Government, including cash appropriations, contract and tonnage authorizations, and commitments by the Reconstruction Finance Corporation and its subsidiaries.

Expenditures include checks paid from the Treasury General Fund and net expenditures by the Reconstruction Finance Corp. and its subsidiaries.

THE RISING CURVE OF CUMULATIVE EXPENDITURES

JUNE 30, 1940, TO NOVEMBER 30, 1944



Direct Debt of the U. S. Government

(Gross Debt in Thousands of Dollars)

Year Ending June 30	Gross Debt	Debt per Capita
1900	$1,263,000	$ 16.56
1905	1,132,357	13.60
1910	1,146,940	12.69
1915	1,191,264	11.83
1916	1,225,146	11.96
1917	2,975,619	28.57
1918	12,243,629	115.65
1919	25,482,034	240.09
1920	24,297,918	228.32
1921	23,976,251	221.09
1922	22,964,079	208.97
1923	22,349,688	200.10
1924	21,251,120	186.86
1925	20,516,272	177.82
1926	19,643,183	167.70
1927	18,510,174	156.04
1928	17,604,291	146.69
1929	16,931,198	139.40
1930	16,185,308	131,49
1931	16,801,485	135.37
1932	19,487,010	155.93
1933	22,538,672	179.21
1934	27,053,086	213,65
1935	28,701,167	225.07
1936	33,545,385	261,20
1937	36,427,091	281,82
1938	37,167,487	285.43
1939	40,445,417	308.34
1940	42,971,044	325,66
1941	48,978,919	367,68
1942	72,495,183	540.68
1943	136,696,000	1,007.64
1944	201,003,000	1,500.00
1945, Jan. 31	232,408,030	1,734.00

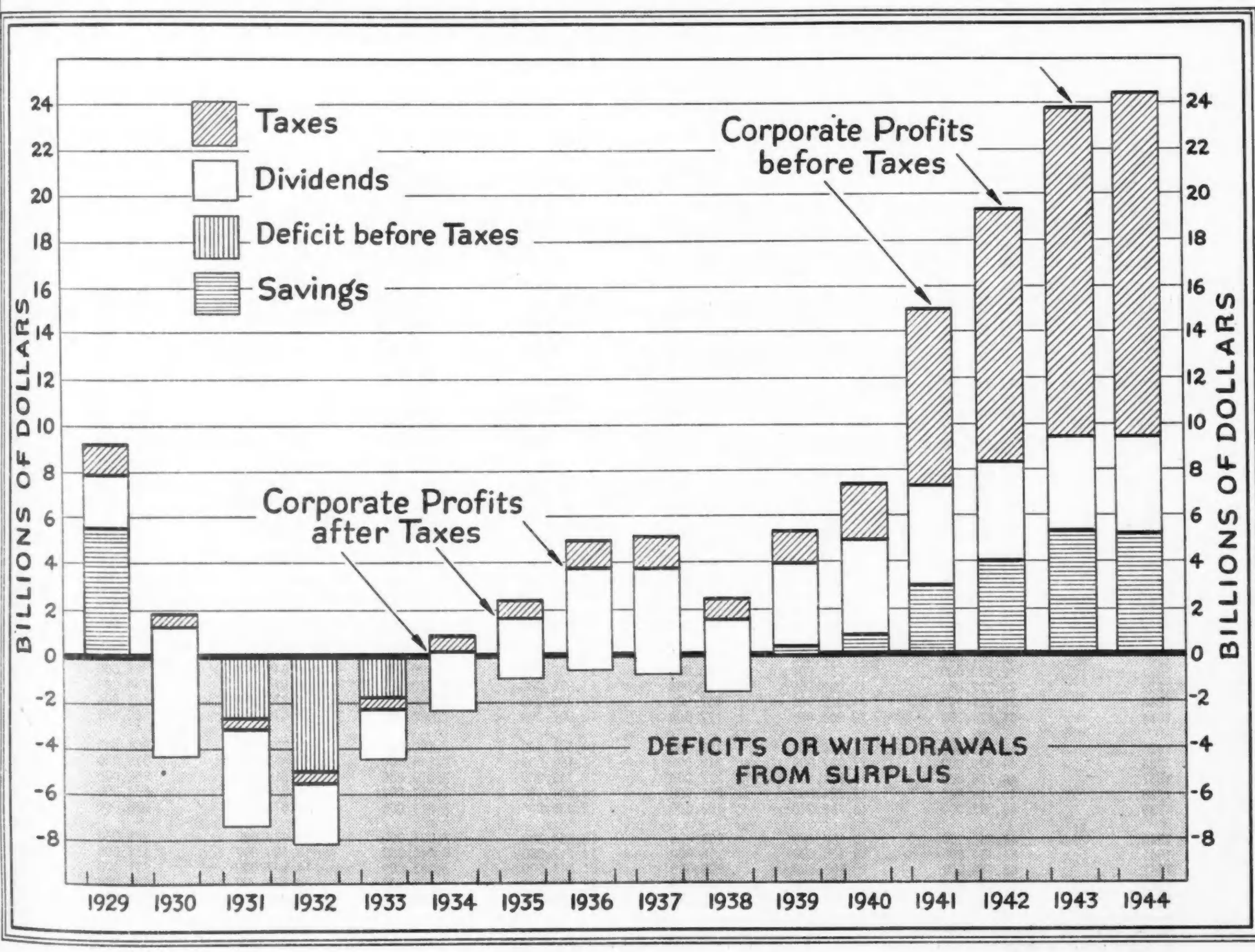
Corporate Profits, Taxes, Dividends and Savings

(Millions of Dollars)

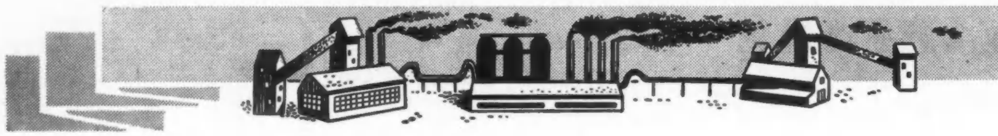
	Corporate Profits Before Taxes	Taxes	Corporate Profits After Taxes	Dividends	Savings
1929	$9,153	$1,181	$7,972	$5,778	$2,194
1930	1,979	700	1,279	5,658	=4,379
1931	−2,836	389	−3,225	4,209	=7,434
1932	−5,187	275	−5,462	2,652	=8,114
1933	−1,969	421	−2,390	2,123	=4,513
1934	725	596	129	2,697	=2,526
1935	2,407	735	1,672	2,951	=1,279
1936	5,089	1,191	3,898	4,735	= 837
1937	5,173	1,276	3,897	4,863	= 966
1938	2,375	860	1,515	3,375	=1,860
1939	5,320	1,232	4,088	3,869	221
1940	7,390	2,543	4,847	4,095	752
1941	14,908	7,577	7,331	4,476	2,855
1942	19,394	11,076	8,318	4,227	4,091
1943	23,848	14,428	9,420	4,273	5,147
1944	24,448	14,962	9,486	4,414	5,072

− Deficit. = Withdrawals from Surplus.
Source: National Income Unit, Department of Commerce.

THE INCREASING LOAD OF CORPORATION TAXES

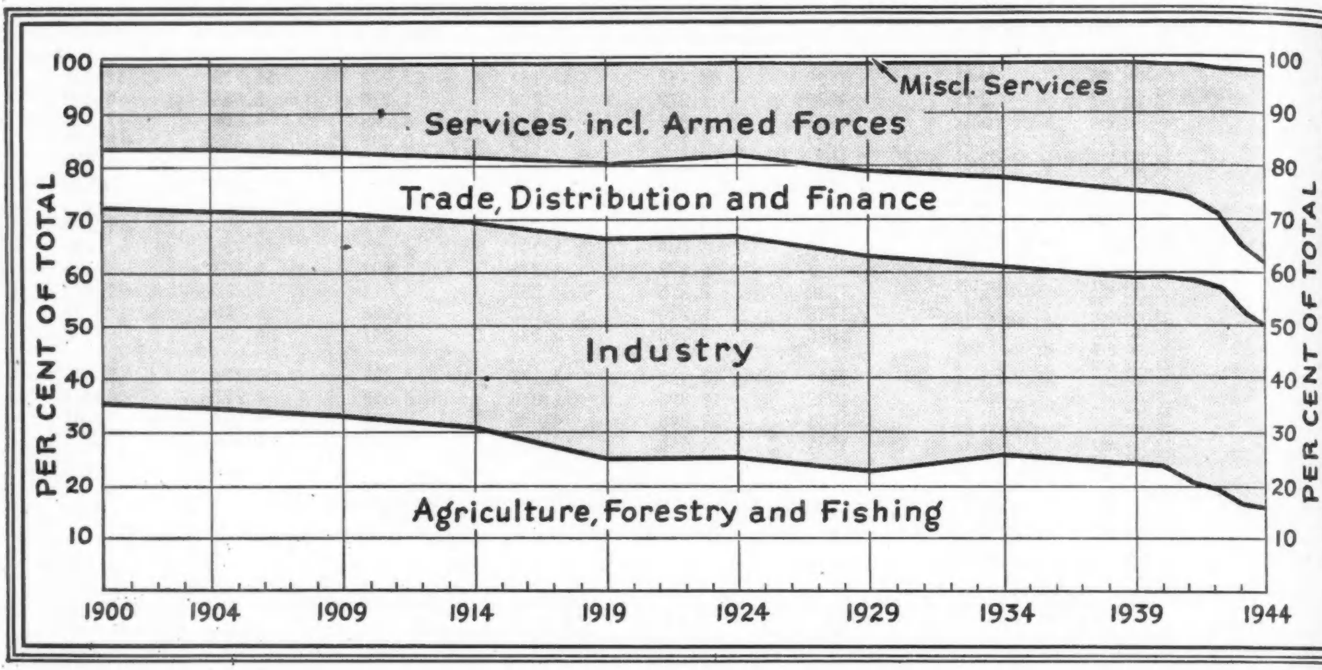


(For Lend-Lease data see page 82)



EMPLOYMENT OF THE LABOR FORCE BY GROUPS

SHOWN IN PER CENT OF TOTAL FORCE



Distribution of Employment of the Labor Force

Including The Military Services

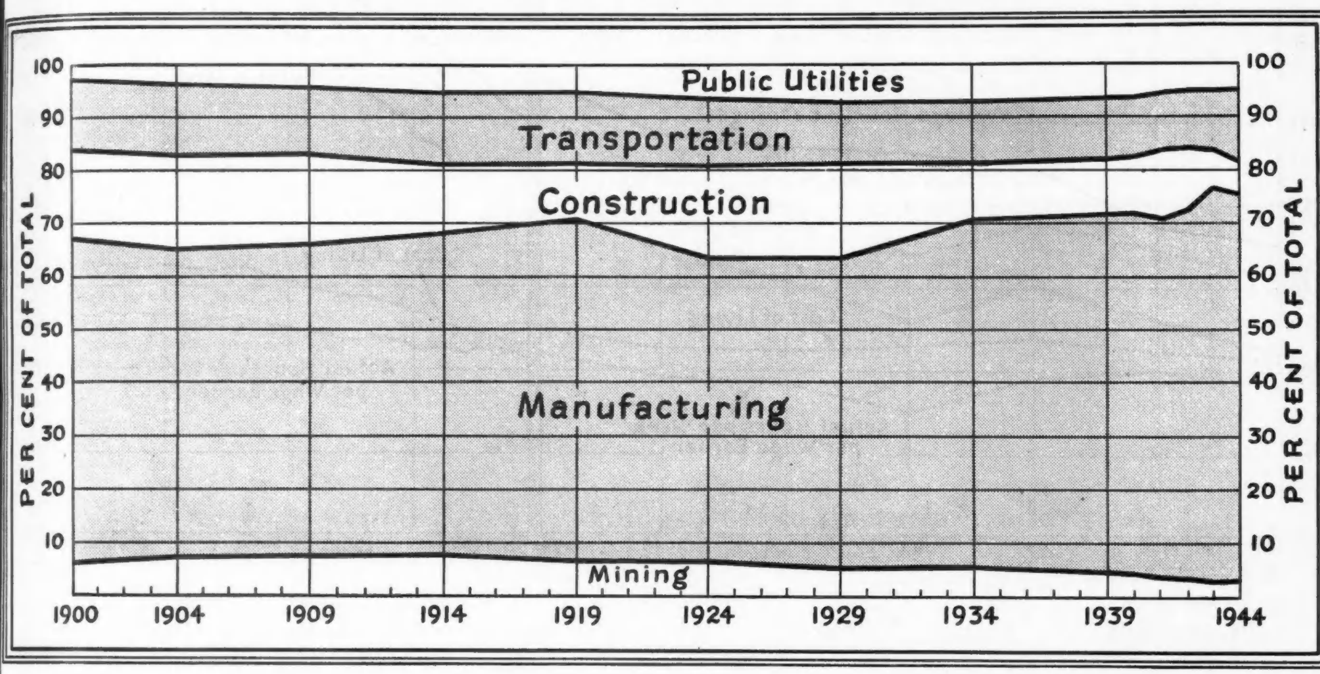
Annual Average	Total	Agriculture†	Forestry and Fishing	Industry	Trade Distribution and Finance	Service Industries (Incl. Armed Forces)	Miscl. Industries and Services
1900	27,378,000	9,552,000	166,000	10,013,000	3,224,000	3,942,000	481,000
1904	31,175,000	10,587,000	195,000	11,599,000	3,730,000	4,508,000	556,000
1909	36,735,000	11,599,000	211,000	14,384,000	4,522,000	5,339,000	680,000
1910	37,580,000	11,610,000	214,000	14,965,000	4,622,000	5,467,000	702,000
1911	37,097,000	11,493,000	216,000	14,591,000	4,588,000	5,517,000	692,000
1912	38,169,000	11,473,000	230,000	15,273,000	4,726,000	5,745,000	722,000
1913	38,482,000	11,451,000	233,000	15,330,000	4,797,000	5,940,000	731,000
1914	37,575,000	11,404,000	228,000	14,507,000	4,742,000	5,987,000	707,000
1915	37,728,000	11,371,000	225,000	14,489,000	4,962,000	5,969,000	712,000
1916	40,127,000	11,382,000	239,000	16,019,000	5,463,000	6,247,000	777,000
1917	42,685,000	11,161,000	228,000	17,518,000	5,808,000	7,117,000	853,000
1918	44,187,000	10,731,000	214,000	17,716,000	5,731,000	8,889,000	906,000
1919	42,029,000	10,489,000	229,000	17,237,000	5,847,000	7,373,000	854,000
1920	41,339,000	10,718,000	236,000	17,362,000	5,643,000	6,552,000	828,000
1921	37,691,000	10,751,000	202,000	14,440,000	5,360,000	6,209,000	729,000
1922	40,049,000	10,766,000	233,000	15,828,000	5,935,000	6,495,000	792,000
1923	43,011,000	10,697,000	262,000	17,917,000	6,377,000	6,884,000	874,000
1924	42,515,000	10,662,000	255,000	17,381,000	6,400,000	6,956,000	861,000
1925	44,192,000	10,725,000	266,000	18,140,000	6,892,000	7,264,000	905,000
1926	45,498,000	10,801,000	260,000	18,708,000	7,054,000	7,736,000	939,000
1927	45,319,000	10,519,000	253,000	18,388,000	7,105,000	8,112,000	942,000
1928	46,057,000	10,552,000	252,000	18,377,000	7,444,000	8,471,000	961,000
1929	47,925,000	10,539,000	267,000	19,097,000	8,007,000	9,003,000	1,012,000
1930	46,081,000	11,172,000	221,000	17,023,000	7,802,000	8,917,000	945,000
1931	42,530,000	11,157,000	160,000	14,520,000	7,300,000	8,543,000	851,000
1932	38,727,000	11,068,000	138,000	11,978,000	6,779,000	8,014,000	750,000
1933	38,827,000	11,027,000	157,000	12,285,000	6,728,000	7,877,000	753,000
1934	41,474,000	10,855,000	177,000	14,097,000	7,097,000	8,416,000	830,000
1935	42,653,000	11,130,000	192,000	14,541,000	7,167,000	8,770,000	854,000
1936	44,830,000	11,037,000	212,000	16,152,000	7,349,000	9,165,000	915,000
1937	46,279,000	10,884,000	227,000	17,142,000	7,549,000	9,518,000	958,000
1938	43,416,000	10,794,000	201,000	14,904,000	7,317,000	9,316,000	884,000
1939	44,993,000	10,739,000	198,000	15,639,000	7,511,000	9,978,000	928,000
1940	46,683,000	10,580,000	208,000	16,854,000	7,631,000	10,432,000	978,000
1941	51,434,000	10,355,000	215,000	19,717,000	7,843,000	12,190,000	1,114,000
1942	55,762,000	10,392,000	209,000	21,349,000	7,633,000	14,947,000	1,231,000
1943	62,026,000	10,264,000	188,000	22,167,000	7,479,000	20,523,000	1,406,000
1944*	63,147,000	10,167,000	175,000	21,396,000	7,425,000	22,540,000	1,439,000

Source—National Industrial Conference Board. *—10 months average.
†—Employment in agriculture revised 1930 to date. Not strictly comparable with previous years.

INDUSTRIAL STATISTICS

EMPLOYMENT IN INDUSTRY BY GROUPS

SHOWN IN PER CENT OF TOTAL INDUSTRY EMPLOYMENT



Distribution of Employment in Industry

Annual Average	Total Industry	Mining	Manufacturing	Construction	Transportation	Public Utilities
1900	10,013,000	653,000	6,090,000	1,639,000	1,355,000	276,000
1904	11,599,000	840,000	6,754,000	1,954,000	1,659,000	392,000
1909	14,384,000	1,103,000	8,446,000	2,333,000	1,933,000	569,000
1910	14,965,000	1,168,000	8,990,000	2,177,000	2,015,000	615,000
1911	14,591,000	1,144,000	8,628,000	2,131,000	2,029,000	659,000
1912	15,273,000	1,181,000	8,909,000	2,374,000	2,112,000	697,000
1913	15,330,000	1,253,000	9,099,000	2,126,000	2,123,000	729,000
1914	14,507,000	1,132,000	8,769,000	1,801,000	2,061,000	744,000
1915	14,489,000	1,144,000	8,911,000	1,644,000	2,035,000	755,000
1916	16,019,000	1,270,000	10,184,000	1,694,000	2,072,000	799,000
1917	17,518,000	1,357,000	11,436,000	1,722,000	2,172,000	831,000
1918	17,716,000	1,341,000	11,446,000	1,767,000	2,311,000	851,000
1919	17,237,000	1,131,000	10,989,000	1,808,000	2,432,000	877,000
1920	17,362,000	1,232,000	11,013,000	1,582,000	2,603,000	932,000
1921	14,440,000	959,000	8,599,000	1,704,000	2,265,000	913,000
1922	15,828,000	954,000	9,391,000	2,311,000	2,232,000	940,000
1923	17,917,000	1,251,000	10,592,000	2,591,000	2,479,000	1,004,000
1924	17,381,000	1,135,000	9,896,000	2,897,000	2,413,000	1,040,000
1925	18,140,000	1,120,000	10,222,000	3,279,000	2,453,000	1,066,000
1926	18,708,000	1,198,000	10,386,000	3,497,000	2,523,000	1,104,000
1927	18,388,000	1,122,000	10,164,000	3,468,000	2,508,000	1,126,000
1928	18,377,000	1,053,000	10,312,000	3,438,000	2,431,000	1,143,000
1929	19,097,000	1,067,000	11,059,000	3,340,000	2,465,000	1,167,000
1930	17,023,000	973,000	9,770,000	2,842,000	2,287,000	1,151,000
1931	14,520,000	825,000	8,423,000	2,225,000	2,006,000	1,041,000
1932	11,978,000	668,000	7,348,000	1,312,000	1,719,000	932,000
1933	12,285,000	677,000	7,979,000	1,114,000	1,656,000	858,000
1934	14,097,000	794,000	9,179,000	1,518,000	1,724,000	883,000
1935	14,541,000	798,000	9,757,000	1,344,000	1,757,000	885,000
1936	16,152,000	825,000	10,485,000	2,014,000	1,905,000	922,000
1937	17,142,000	865,000	11,361,000	1,924,000	2,016,000	975,000
1938	14,904,000	750,000	9,538,000	1,875,000	1,799,000	942,000
1939	15,639,000	707,000	10,517,000	1,610,000	1,871,000	934,000
1940	16,854,000	756,000	11,288,000	1,907,000	1,948,000	956,000
1941	19,717,000	758,000	13,198,000	2,612,000	2,135,000	1,015,000
1942	21,349,000	780,000	14,632,000	2,624,000	2,276,000	1,037,000
1943	22,167,000	702,000	16,205,000	1,764,000	2,476,000	1,021,000
1944*	21,396,000	648,000	15,540,000	1,329,000	2,899,000	980,000

Source—National Industrial Conference Board.
*—Ten months average.

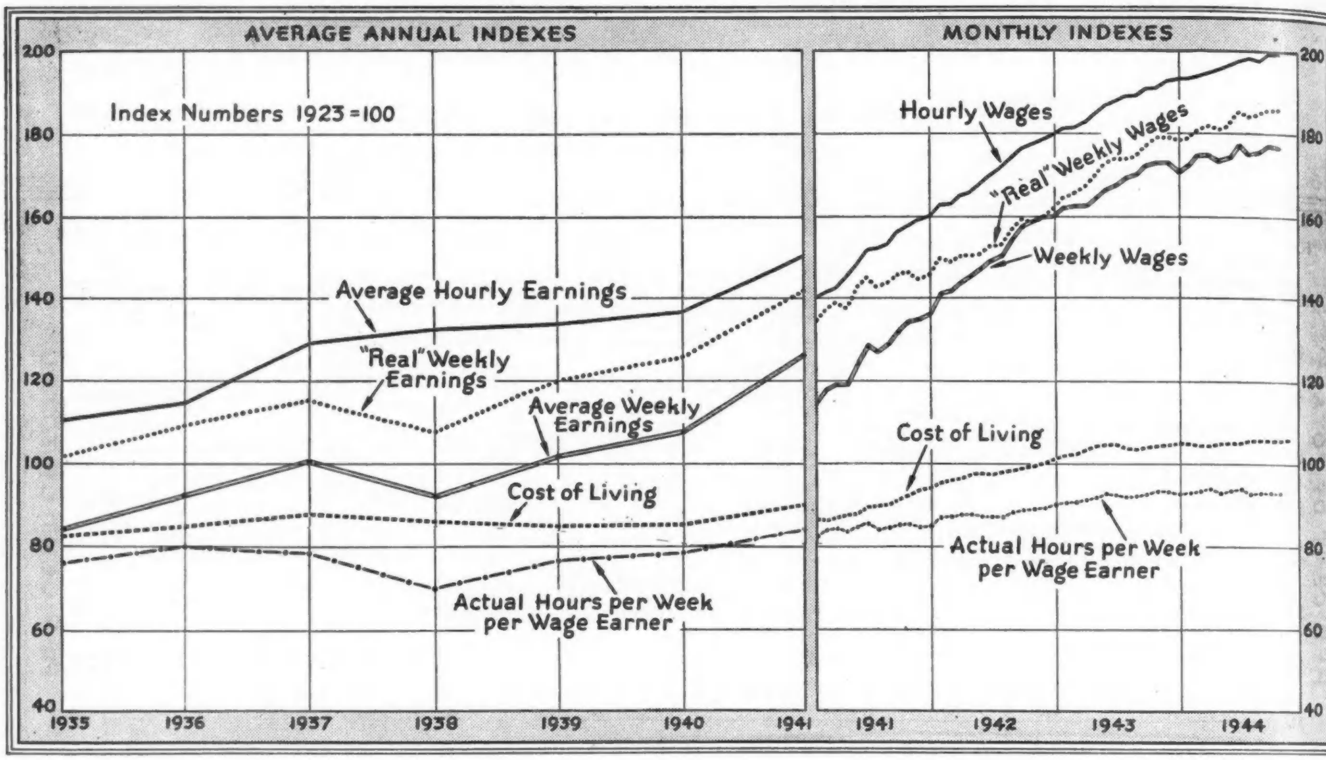
Wage Earners in U. S. Automotive Plants*

(In Thousands)

Monthly Average	Men	Women	Total
1941	...	...	487
1942	...	...	505
1943			
January	561	98	659
February	559	116	675
March	556	132	688
April	550	153	703
May	556	156	712
June	567	160	727
July	568	175	743
August	576	188	764
September	591	204	795
October	600	217	817
November	599	225	824
December	601	218	819
Average	574	170	744
1944			
January	598	214	812
February	593	210	803
March	581	210	791
April	566	212	778
May	555	207	762
June	548	207	755
July	543	206	749
August	541	205	746
September	533	198	731
October	522	190	712
November	512	178	690
December	509	169	678
Average	550	201	751

*—Automotive Council for War Production. Includes those plants formerly manufacturing Motor Vehicles and Bodies and the U. S.-Owned plants operated by these companies.

INDEXES OF WAGE EARNINGS
IN 25 MANUFACTURING INDUSTRIES



Earnings and Hours Worked in 25 Manufacturing and Automobile Industries

	Average Hourly Earnings		Average Weekly Earnings		Avg. Actual Hours per Week per Wage Earner	
	25 Mfg. Industries	Automotive Industry*	25 Mfg. Industries	Automobile Industry*	25 Mfg. Industries	Automobile Industry*
1929	$ .590	$ .625	$28.55	$32.48	48.3	46.8
1930	.589	.618	25.84	27.77	43.9	39.9
1931	.564	.602	22.62	25.13	40.4	36.9
1932	.498	.546	17.05	18.50	34.8	30.4
1933	.491	.535	17.71	21.84	36.4	36.0
1934	.580	.609	20.06	23.64	34.7	33.2
1935	.599	.666	22.23	28.04	37.2	37.4
1936	.619	.675	24.39	29.81	39.5	37.7
1937	.695	.777	26.80	32.31	38.7	35.3
1938	.716	.800	24.43	30.77	34.3	32.3
1939	.720	.805	27.04	33.28	37.6	34.9
1940	.739	.818	28.54	36.24	38.6	37.3
1941	.814	.905	33.62	42.34	41.2	39.0
1942	.924	1,003	40.03	55.55	43.0	44.5
1943	1.014	1.087	45.88	58.95	45.0	45.0
1944†	1.065	1.312	48.73	59.33	45.6	45.2
1943						
January	.979	1.299	43.56	59.56	44.3	45.9
February	.982	1.271	43.85	58.63	44.5	46.1
March	.987	1.283	44.30	58.36	44.7	45.5
April	.998	1.281	45.02	58.42	44.9	45.6
May	1.009	1.298	45.92	60.88	45.3	46.9
June	1.016	1.302	46.16	59.16	45.2	45.4
July	1.020	1.301	46.14	59.60	45.0	45.8
August	1.020	1.289	46.25	58.88	45.1	45.7
September	1.036	1.312	47.12	58.52	45.3	44.6
October	1.036	1.303	47.51	62.59	45.5	48.0
November	1.041	1.310	47.58	59.52	45.5	45.4
December	1.045	1.283	47.15	53.71	45.1	41.9
1944						
January	1.046	1.295	47.56	60.25	45.2	46.5
February	1.048	1.299	48.15	59.78	45.7	46.0
March	1.053	1.303	48.41	59.54	45.8	45.7
April	1.057	1.309	48.09	62.07	45.2	47.4
May	1.062	1.320	48.46	58.30	45.5	44.2
June	1.069	1.320	49.30	60.17	45.9	45.6
July	1.072	1.329	48.86	59.13	45.4	44.5
August	1.070	1.317	48.98	59.19	45.6	44.9
September	1.080	1.315	49.42	58.09	45.6	44.2
October	1.079	1.305	49.39	57.91	45.7	44.4
November	1.080	1.315	49.46	58.24	45.6	44.3

Note—Hourly Earnings are not Wage Rates because they include overtime and incentive payments. *—Based on data collected by the Automobile Manufacturers Association and the Conference Board. †—January through November.

Source—National Industrial Conference Board.

Cost of Living Index

Index, 1923=100

	Weighted Average All Items	Food	Housing	Clothing	Fuel and Light	Sundries
1929	100.1	106.9	92.0	98.7	93.4	99.7
1930	96.7	101.7	89.5	92.0	92.7	98.7
1931	87.2	83.7	82.4	79.5	90.5	96.6
1932	77.9	69.7	72.4	66.5	86.9	93.6
1933	74.9	67.8	63.8	67.6	85.2	91.4
1934	79.4	75.3	64.8	77.5	86.9	93.2
1935	82.2	80.8	70.3	75.0	85.7	93.8
1936	84.1	81.6	77.9	73.8	86.0	94.6
1937	87.8	84.7	86.5	76.9	85.2	96.9
1938	85.7	78.7	87.0	74.3	85.2	97.3
1939	84.5	76.6	86.3	72.3	84.9	96.8
1940	85.3	77.7	86.9	73.1	85.4	97.5
1941	89.0	85.3	88.5	75.3	87.9	99.4
1942	97.8	100.8	90.8	87.3	90.2	104.5
1943	103.3	112.6	90.8	89.3	92.7	107.4
1944	104.6	110.9	90.9	92.6	95.2	113.0
1943						
January	101.5	108.8	90.8	88.6	92.1	106.4
February	101.9	110.0	90.8	88.6	92.3	106.5
March	103.0	112.8	90.8	88.6	92.4	106.5
April	104.0	115.4	90.8	88.6	92.5	106.5
May	104.2	115.8	90.8	88.5	92.6	106.7
June	104.3	115.8	90.8	88.6	92.5	107.1
July	103.1	112.4	90.8	88.9	92.5	107.2
August	102.8	111.4	90.8	89.3	92.6	107.3
September	103.1	112.0	90.8	89.8	92.6	107.4
October	103.7	112.6	90.8	90.6	92.7	108.6
November	103.7	112.1	90.8	90.9	93.1	109.1
December	103.9	111.9	90.8	91.1	94.9	110.0
1944						
January	103.9	111.1	90.8	91.2	95.1	110.5
February	103.4	109.6	90.8	91.6	96.0	110.6
March	103.4	109.2	90.8	91.7	95.3	111.5
April	104.1	110.1	90.8	91.9	95.3	112.8
May	104.4	110.7	90.8	92.3	95.3	113.2
June	104.4	110.6	90.8	92.5	95.1	113.3
July	105.0	111.9	90.9	92.5	95.1	113.3
August	105.1	111.9	90.9	93.0	95.1	113.4
September	105.0	111.5	90.9	93.2	95.1	113.6
October	105.1	111.1	91.0	93.6	95.1	114.2
November	105.2	111.1	91.0	93.9	95.2	114.7
December	105.6	112.2	91.0	94.0	95.2	114.8

Source—National Industrial Conference Board.

WAGES AND HOURS WORKED

Average Actual Weekly Earnings in Manufacturing Industries

INDUSTRY	1929	1932	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944*
Agricultural Implement	$31.02	$17.96	$26.42	$26.78	$31.08	$28.08	$30.53	$32.13	$37.59	$43.47	$50.55	$53.46
Automobile	32.48	18.50	28.04	29.81	32.31	30.77	33.28	36.24	42.34	55.55	58.95	59.33
Boot and Shoe	22.16	16.67	21.15	20.89	20.89	17.78	18.73	18.19	22.39	25.99	27.99	30.90
Chemical	28.87	19.68	23.79	24.86	28.74	27.97	29.74	31.39	34.85	(a)	47.05	49.23
Cotton—North	20.20	14.10	16.31	17.34	19.44	17.89	18.56	19.14	22.47	28.21	32.51	33.73
Electrical Manufacturing	29.66	17.43	24.14	26.22	29.32	27.06	30.37	33.03	39.60	46.55	49.56	52.31
Furniture	25.82	15.04	20.32	22.96	24.95	23.00	25.38	26.77	31.97	37.01	45.32	46.81
Hosiery and Knit Goods	23.58	15.26	17.96	18.28	20.30	19.46	20.08	19.85	21.42	25.51	31.42	33.77
Iron and Steel	35.90	14.51	22.42	26.65	29.92	22.91	29.09	30.69	36.92	40.41	48.81	55.35
Leather Tanning and Finishing	24.91	18.74	21.11	22.01	23.67	22.57	24.84	24.61	28.66	33.25	36.85	41.01
Lumber and Millwork	26.32	14.97	19.48	24.39	25.90	25.36	27.12	28.16	32.48	40.25	48.08	49.87
Meat Packing	26.12	20.77	23.14	23.71	26.75	28.13	27.94	27.77	29.25	32.61	40.56	46.33
Paint and Varnish	30.17	21.43	22.90	27.86	28.32	27.61	29.23	29.45	32.76	(a)	44.37	48.30
Paper and Pulp	28.21	18.98	21.07	23.20	26.06	24.83	26.10	27.52	31.26	35.21	41.29	43.80
Paper Products	26.23	19.03	20.00	21.56	23.26	23.08	24.42	24.74	27.61	31.04	35.57	37.24
Printing—Book and Job	33.34	27.31	28.28	28.81	30.27	30.09	32.28	33.33	34.79	36.83	41.22	45.32
Printing—News and Magazines	40.35	33.17	31.18	32.56	34.55	34.71	35.72	36.43	37.51	39.61	43.82	47.50
Rubber	29.58	19.87	26.52	27.64	28.16	25.52	30.65	31.01	35.65	41.41	51.24	55.90
Silk and Rayon	23.25	14.94	16.89	17.33	18.22	16.96	18.23	18.24	20.80	25.86	30.69	33.77
Wool	22.39	15.09	18.91	19.19	21.03	19.62	21.31	22.34	27.44	32.42	37.80	39.46
Foundries and Machine Shops	30.00	15.77	22.46	25.30	28.85	24.98	28.53	31.56	38.93	47.51	53.14	56.16

Source—National Industrial Conference Board. *—January through November.
(a)—A change in sample in middle of 1942, hence no average.

Average Actual Hourly Earnings in Manufacturing Industries

Note: Hourly Earnings are not wage rates, because they include overtime and incentive payments.

INDUSTRY	1929	1932	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944*
Agricultural Implement	$.625	$.546	$.666	$.675	$.777	$.800	$.805	$.818	$.905	$1.003	$1.087	$1.135
Automobile	.695	.609	.752	.791	.916	.953	.953	.971	1.086	1.248	1.295	1.312
Boot and Shoe	.501	.405	.570	.567	.546	.542	.519	.538	.590	.669	.701	.738
Chemical	.574	.485	.606	.623	.722	.748	.758	.787	.849	(a)	1.057	1.089
Cotton—North	.420	.333	.448	.452	.514	.500	.491	.511	.564	.671	.748	.775
Electrical Manufacturing	.627	.594	.667	.669	.756	.801	.796	.814	.904	1.012	1.067	1.130
Furniture	.551	.448	.537	.550	.619	.653	.661	.681	.757	.850	.953	1.001
Hosiery and Knit Goods	.496	.397	.520	.511	.556	.573	.547	.559	.577	.666	.768	.817
Iron and Steel	.654	.531	.655	.670	.818	.830	.841	.850	.957	1.037	1.135	1.182
Leather Tanning and Finishing	.524	.459	.555	.563	.621	.635	.643	.658	.708	.803	.859	.905
Lumber and Millwork	.580	.412	.495	.599	.660	.692	.704	.726	.797	.927	1.060	1.093
Meat Packing	.516	.431	.570	.566	.672	.695	.696	.693	.748	.817	.879	.928
Paint and Varnish	.583	.517	.575	.615	.689	.707	.718	.732	.789	(a)	.973	1.012
Paper and Pulp	.541	.468	.533	.545	.620	.645	.641	.668	.725	.817	.876	.900
Paper Products	.530	.464	.523	.526	.568	.603	.611	.628	.666	.752	.807	.849
Printing—Book and Job	.725	.710	.736	.724	.749	.790	.823	.826	.846	.884	.961	1.051
Printing—News and Magazines	.884	.786	.862	.875	.912	.950	.966	.978	.987	1.019	1.088	1.147
Rubber	.661	.599	.801	.756	.847	.841	.863	.876	.927	1.010	1.125	1.204
Silk and Rayon	.487	.385	.527	.507	.516	.526	.518	.529	.554	.639	.728	.776
Wool	.483	.385	.516	.531	.608	.608	.595	.623	.688	.794	.879	.911
Foundries and Machine Shops	.608	.524	.594	.611	.699	.728	.738	.761	.850	.999	1.109	1.186

Source—National Industrial Conference Board. (a)—A change in sample in middle of 1942, hence no average.
*—January through November.

Average Actual Hours per Week per Wage Earner by Years

INDUSTRY	1929	1932	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944*
Agricultural Implement	49.6	32.9	39.7	39.7	40.0	35.1	37.9	39.3	41.6	43.3	46.5	47.1
Automobile	46.8	30.4	37.4	47.7	35.3	32.3	34.9	37.3	39.0	44.5	45.5	45.2
Boot and Shoe	44.2	41.1	37.1	36.8	38.3	32.8	36.1	33.8	38.0	38.8	40.0	41.9
Chemical	50.4	40.7	39.3	39.9	39.8	37.4	39.3	39.9	41.0	(a)	44.5	45.2
Cotton—North	48.2	42.5	36.4	38.4	37.9	35.7	37.8	37.5	39.8	42.0	43.4	43.5
Electrical Manufacturing	47.4	29.4	36.2	39.2	38.8	33.8	38.2	40.6	43.8	46.0	46.4	46.3
Furniture	46.9	33.6	37.8	41.8	40.4	35.3	38.4	39.3	42.2	43.5	47.5	46.7
Hosiery and Knit Goods	47.6	38.5	34.5	35.8	36.6	34.0	36.7	35.5	37.1	38.2	40.9	41.3
Iron and Steel	54.9	27.2	34.2	39.8	36.6	27.6	34.6	36.1	38.6	39.0	43.0	46.8
Leather Tanning and Finishing	47.6	40.9	38.1	39.1	38.2	35.6	38.6	37.4	40.5	41.4	42.9	45.3
Lumber and Millwork	45.4	36.4	39.3	40.7	39.3	36.6	38.5	38.8	40.7	43.3	45.3	45.6
Meat Packing	50.6	48.2	40.6	41.9	39.8	40.5	40.1	40.1	39.1	39.9	46.1	49.9
Paint and Varnish	51.8	41.4	39.9	45.3	41.2	39.0	40.7	40.3	41.5	(a)	45.6	47.7
Paper and Pulp	52.1	40.6	39.6	42.6	42.1	38.5	40.7	41.2	43.1	43.1	47.1	48.7
Paper Products	49.5	41.1	38.2	41.0	41.0	38.3	40.0	39.4	41.4	41.3	44.1	43.9
Printing—Book and Job	46.0	38.5	38.4	39.8	40.4	38.1	39.2	40.3	41.1	41.6	42.9	43.1
Printing—News and Magazines	45.7	42.1	36.2	37.2	37.9	36.6	37.0	37.3	38.0	38.8	40.2	41.4
Rubber	44.8	33.1	33.1	36.6	33.3	30.3	35.5	35.4	38.5	40.9	45.5	46.4
Silk and Rayon	47.8	38.9	32.1	34.2	35.3	32.3	35.2	34.4	37.6	40.4	42.1	43.5
Wool	46.4	39.3	36.7	36.1	34.7	32.4	35.8	35.9	39.9	40.8	43.0	43.3
Foundries and Machine Shops	49.4	30.1	37.8	41.4	41.4	34.3	38.6	41.4	45.8	47.6	47.9	47.3

Source—National Industrial Conference Board. *—January through November.
(a)—A change in sample in middle of 1942, hence no average.

(For data on Machine Tools see page 80)

Value of War Product Deliveries by the Automotive Industry—by Types

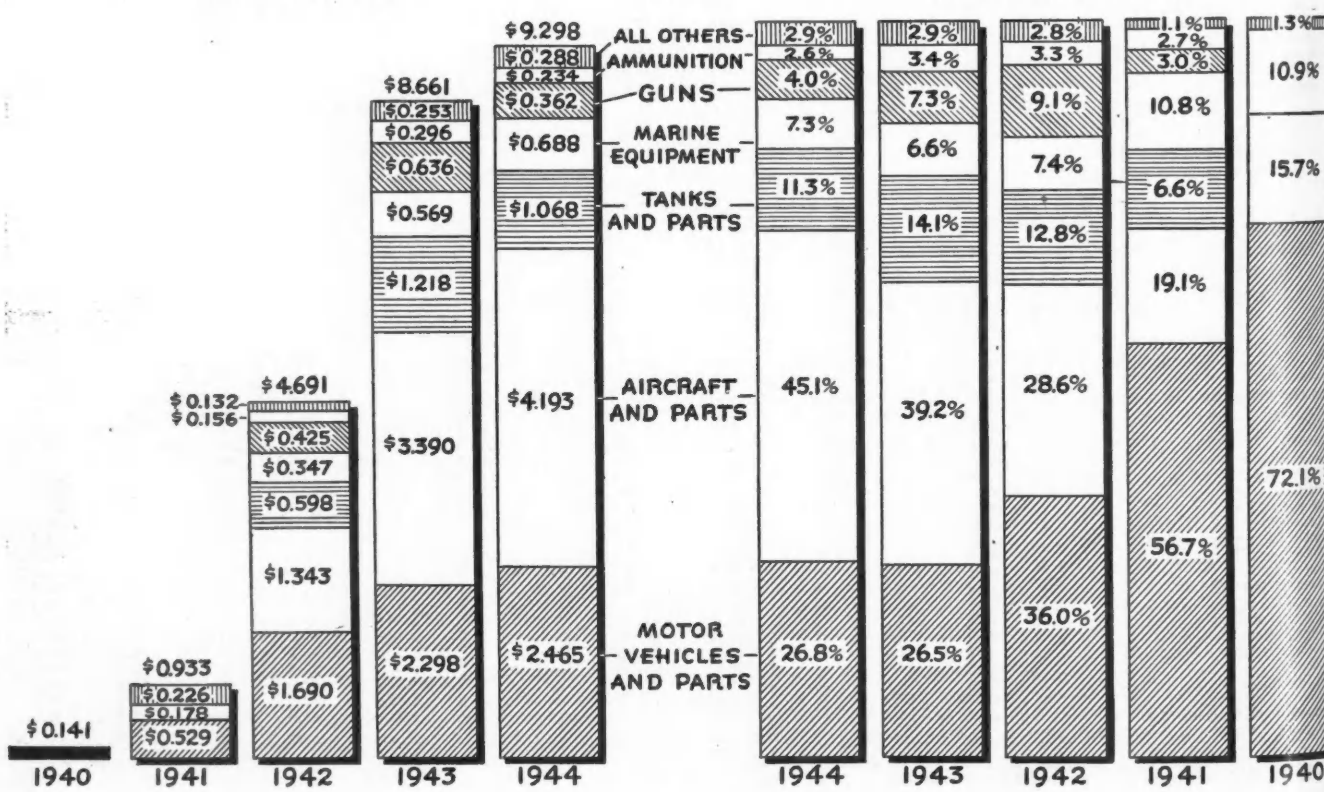
(Thousands of Dollars)

Period in Quarters	Aircraft, Engines and Parts	Tanks and Parts	Motor Vehicles and Parts	Guns	Marine Equipment	Ammunition	All Other	Total
1941								
First	$17,415	$......	$75,943	$ 397	$17,378	$ 347	$ 253	$111,733
Second	26,364	1,130	119,245	1,711	28,232	2,904	1,772	181,358
Third	48,107	25,332	134,251	11,874	29,313	8,006	2,134	259,017
Fourth	86,446	35,154	199,705	13,548	26,293	13,564	6,335	381,045
1942								
First	139,690	41,773	304,142	58,278	29,673	22,995	14,877	611,428
Second	281,238	85,894	404,751	90,507	65,591	32,469	27,624	988,074
Third	404,181	153,472	489,353	123,312	108,408	46,702	39,918	1,365,346
Fourth	517,566	316,975	491,398	153,264	143,156	53,563	50,202	1,726,124
1943								
First	617,016	332,532	467,035	171,981	146,702	68,667	47,802	1,851,735
Second	799,738	327,250	543,931	167,833	144,583	68,085	58,340	2,109,760
Third	951,093	286,219	656,245	166,251	140,880	80,396	72,225	2,353,309
Fourth	1,022,893	271,740	630,676	129,991	137,271	79,156	74,798	2,346,525
1944								
First	1,055,751	214,496	633,530	108,949	184,938	68,658	72,513	2,338,835
Second	1,070,799	281,919	580,337	91,906	183,095	57,101	75,163	2,340,320
Third	1,037,018	277,027	622,727	87,783	154,107	53,614	62,202	2,294,478
Fourth*	1,036,432	276,558	663,406	86,362	157,860	60,627	65,122	2,346,367
Year								
1940	22,237	....	102,105	338	15,441	187	1,266	141,575
1941	178,333	61,616	529,144	27,530	101,216	24,821	10,494	933,154
1942	1,342,676	598,113	1,689,644	425,361	346,828	155,730	132,620	4,690,971
1943	3,390,739	1,217,741	2,297,887	636,056	569,437	296,304	253,166	8,661,330
1944*	4,193,000	1,068,000	2,465,000	362,000	688,000	234,000	288,000	9,298,000

*—Estimated. Source—Automotive Council for War Production

WAR PRODUCT DELIVERIES BY AUTOMOTIVE INDUSTRY

DOLLAR VOLUME AND PER CENT OF TOTAL



Total U. S. Motor Vehicle Registrations by Years

Showing Increases and Decreases

Year	Passenger Cars	Trucks and Buses	Total Motor Vehicles	Per Cent Increase
1895	4	....	4	....
1896	16	....	16	....
1897	90	....	90	....
1898	800	....	800	....
1899	3,200	....	3,200	....
1900	8,000	....	8,000	....
1901	14,800	....	14,800	....
1902	23,000	....	23,000	....
1903	32,920	....	32,920	....
1904	54,590	410	55,000	....
1905	77,400	600	78,000	42
1906	105,900	1,100	107,000	37
1907	140,300	1,700	142,000	33
1908	194,400	3,100	197,500	39
1909	305,950	6,050	312,000	58
1910	458,500	10,000	468,500	50
1911	619,500	20,000	639,500	36
1912	902,600	41,400	944,000	48
1913	1,194,161	63,800	1,258,062	33
1914	1,625,739	85,600	1,711,339	36
1915	2,309,666	136,000	2,445,666	43
1916	2,297,996	215,000	3,512,996	44
1917	4,657,340	326,000	4,983,340	42
1918	5,621,617	525,000	6,146,617	23
1919	6,771,074	794,372	7,565,446	23
1920	8,225,859	1,006,082	9,231,941	22
1921	9,346,195	1,118,520	10,464,715	13
1922	10,864,128	1,375,725	12,239,853	17
1923	13,479,608	1,612,569	15,092,177	23
1924	15,460,649	2,134,724	17,595,373	17
1925	17,496,420	2,440,854	19,937,274	13
1926	19,237,171	2,764,222	22,001,393	10
1927	20,219,224	2,914,019	23,133,243	5
1928	21,379,125	3,113,999	24,493,124	6
1929	23,121,589	3,379,854	26,501,443	8
1930	23,183,241	3,473,831	26,657,072	0.2
1931*	22,567,381	3,426,515	25,993,896	−2.5
1932*	21,139,092	3,202,730	24,341,822	−6.4
1933*	20,557,493	3,292,439	23,849,932	−2.0
1934*	21,535,199	3,346,268	24,881,467	4.3
1935*	22,630,715	3,595,042	26,225,757	5.2
1936*	24,161,820	3,929,889	28,091,709	7.2
1937*	25,476,786	4,172,484	29,649,270	5.6
1938*†	25,264,589	4,153,389	29,417,978	−0.8
1939*†	26,147,798	4,496,770	30,644,568	+4.2
1940*†	27,240,475	4,683,376	31,923,851	+4.2
1941*†	29,240,417	4,911,990	34,152,407	+7.0
1942*†	27,683,529	4,741,298	32,424,827	−5.1
1943*†	25,841,215	4,657,882	30,499,097	−6.0
1944*†	25,342,329	4,532,912	29,875,241	−2.1

*—Automotive and Aviation Industries count, all others Bureau of Public Roads.

†—Revised data.

Total Motor Vehicle Registrations by States, 1944-1943

(As of the End of the Registration Year)

State	Passenger Cars 1944	Passenger Cars 1943	Trucks 1944	Trucks 1943	Buses 1944	Buses 1943	Total Motor Vehicles 1944	Total Motor Vehicles 1943	Per Cent Change	Per Cent of Total 1944	Per Cent of Total 1943
Alabama	282,963	288,530	67,198	65,606	1,876	1,464	352,037	355,600	− 1.1	1.18	1.17
Arizona	109,000	108,815	27,500	27,020	660	658(a)	137,160	136,493	+0.5	.46	.45
Arkansas	190,156	194,716	74,459	71,916	939	863	265,554	267,495	−0.7	.89	.88
California	2,321,500(f)	2,302,384(f)	327,375	327,204	5,606	(b)	2,654,481(c)	2,629,588(c)	+0.9	8.89	8.62
Colorado	262,557	277,117	71,970	68,887	(b)	1,430	334,527	347,434	−3.7	1.12	1.14
Connecticut	427,316	441,727	59,966	61,423	1,522	1,493	488,804	504,643	−3.2	1.64	1.65
Delaware	52,801	54,636	14,371	13,576	(b)	(b)	67,172	68,212	−1.5	.22	.22
District of Columbia	109,625	119,734	13,563	15,037	2,155	2,292	125,343	137,063	−8.6	.42	.45
Florida	404,630	384,432	88,053	84,132	2,980	2,846	495,663	471,410	+5.1	1.66	1.55
Georgia	424,492	420,970	97,553	93,817	4,645	4,140	526,690	518,927	+1.5	1.76	1.79
Idaho	111,797	114,145	35,533(a)	35,724	233	479	147,563	150,348	−1.9	.49	.49
Illinois	1,518,629	1,592,837	216,930	221,634	(b)	(b)	1,735,559	1,814,471	−4.4	5.82	5.95
Indiana	809,500	847,362	122,000	124,195	6,800	4,583	938,300	976,140	−3.9	3.14	3.20
Iowa	595,542	614,200	98,373	103,509	(b)	......	693,915	717,709	−3.3	2.32	2.35
Kansas	476,807	487,491	121,804	119,168	(b)	(b)	598,611	606,659	−1.3	2.00	1.99
Kentucky	360,000	363,471	75,295	73,107	......	2,301	435,295	438,879	−0.8	1.46	1.44
Louisiana	309,000	314,622	71,000	70,691	3,150	3,177	383,150	388,490	−1.4	1.28	1.27
Maine	146,227	145,280	44,527	41,959	491	481	191,245	187,720	+1.8	.64	.62
Maryland	398,650	402,236	54,123	61,672	1,432	1,509	454,205	465,417	−2.4	1.52	1.53
Massachusetts	719,215	718,563	103,606	104,253	4,983	4,262	827,804	827,078	−0.1	2.77	2.71
Michigan	1,339,956	1,378,353	115,843(a)	156,656	(b)	(b)	1,455,799	1,535,009	−5.2	4.87	5.04
Minnesota	644,237	672,055	113,666	116,026	335	324	758,238	788,405	−3.8	2.54	2.59
Mississippi	185,000	187,792	61,500	60,900	700	711	247,200	249,403	−0.9	.83	.82
Missouri	688,276	716,619	143,867	148,608	3,681	......	835,824	865,227	−3.4	2.80	2.84
Montana	110,617	115,429	46,730	45,380	(b)	(b)	157,347	160,809	−2.2	.53	.53
Nebraska	326,080	334,967	72,537	71,726	770	703	399,387	407,396	−2.0	1.34	1.33
Nevada	37,230	40,548	10,000	9,850	......	......	47,230	50,398	−6.3	.16	.16
New Hampshire	90,500	84,478	27,500	27,195	(b)	(b)	118,000	111,673	+5.7	.39	.37
New Jersey	845,472	865,063	135,557	135,529	9,033(a)	8,979(a)	990,062	1,009,571	−2.0	3.31	3.29
New Mexico	82,222	86,089	27,826	28,645	1,448(a)	1,296(a)	111,496	116,030	−3.9	.37	.38
New York	1,936,418	1,957,555	282,091	310,258	8,817	29,964(a)	2,227,326	2,297,777	−3.1	7.46	7.54
North Carolina	545,145	504,385	93,063	95,600	2,570	2,270	640,778	602,255	+6.4	2.14	1.97
North Dakota	133,434	134,959	46,946	44,397	151	116	180,531	179,472	+0.6	.60	.59
Ohio	1,700,000	1,777,448	143,000	185,596	3,100	2,977	1,846,100	1,966,021	−6.1	6.18	6.45
Oklahoma	392,249	406,505	102,383	101,969	1,935	1,892	496,567	510,366	−2.7	1.66	1.67
Oregon	331,641	332,552	77,773	74,724	1,219	1,136	410,633	408,412	+0.5	1.37	1.34
Pennsylvania	1,625,928	1,724,501	264,543	275,052	8,194	8,681	1,898,665	2,008,234	−5.5	6.36	6.59
Rhode Island	152,441	161,724	20,800	20,575	673	661	173,914	182,960	−5.0	.58	.60
South Carolina	279,378	283,091	45,701	49,257	......	2,323	325,079	334,671	−2.9	1.09	1.10
South Dakota	142,678	147,082	35,590	35,028	183	179	178,451	182,289	−2.2	.60	.60
Tennessee	367,787	372,199	73,650	71,701	4,263	4,161	445,700	448,061	−0.5	1.49	1.47
Texas	1,264,805	1,270,596	286,669	287,223	1,806	1,762	1,553,280	1,559,581	−0.4	5.21	5.11
Utah	126,929	132,004	25,836	25,549	567	686	153,332	158,239	−3.1	.51	.52
Vermont	74,086	71,305	10,835	10,207	139	147	85,060	81,659	+4.2	.28	.27
Virginia	431,481	424,127	82,912	80,878	2,717	2,743	517,110	507,748	+1.8	1.73	1.66
Washington	506,000	500,790	95,000	94,042	1,800	1,753	603,300	596,585	+1.1	2.02	1.96
West Virginia	203,032	209,527	51,381	47,124	1,015	955	255,428	257,606	−0.9	.85	.84
Wisconsin	686,829	693,559	139,186	135,643	2,268	1,603	828,283	830,805	−0.3	2.77	2.72
Wyoming	62,071	62,645	20,472	20,014	(d)	(d)	82,543	82,659	−0.1	.28	.27
Total	25,342,329	25,841,215	4,438,056	4,549,882	94,856	108,000	29,875,741	30,499,097	−1.9	100.00	100.00

(a)—Includes taxicabs. (b)—Included with trucks. (c)—Does not include 119,313 vehicles originally registered in other states during 1943 and 124,762 during 1944. (d)—Included with passenger cars. (e)—Includes buses. (f)—118,249 light commercial vehicles registered as passenger cars during 1944 were transferred to trucks. 115,842 were transferred during 1943.

In the above tabulation we have endeavored to make as accurate a count as existing conditions permit. This census is compiled from material secured direct from the state motor vehicle commissioners. Wherever possible, duplications, occasioned by transfers and non-resident registrations, have been eliminated. Data are for the registration year rather than the calendar year, even though this necessitates partial estimates in the case of those states whose registration year ends March 1 of the following year.

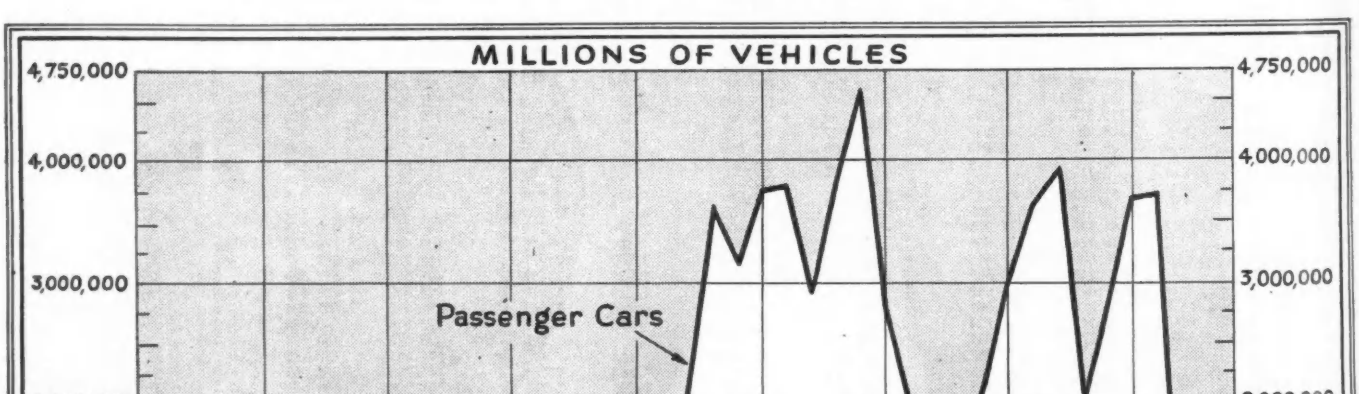
Motor Vehicle Production by Years

Factory Sales and Wholesale Value, U. S. Plants

	PASSENGER CARS			MOTOR TRUCKS			TOTAL	
	Number of Units	Wholesale Value	Average Wholesale Price	Number of Units†	Wholesale Value†	Average Wholesale Price	Number of Units	Wholesale Value
1904	22,130	$23,357,692	$1055	700	$1,272,747	$1818	22,830	$24,630,439
1905	24,250	38,670,000	1594	750	1,330,000	1773	25,000	40,000,000
1906	33,200	61,460,000	1851	800	1,440,000	1800	34,000	62,900,000
1907	43,000	91,620,000	2131	1,000	1,780,000	1780	44,000	93,400,000
1908	63,500	135,250,000	2129	1,500	2,550,000	1700	65,000	137,800,000
1909	123,990	159,765,721	1288	3,297	5,333,683	1617	127,287	165,099,404
1910	181,000	215,340,000	1189	6,000	9,660,000	1610	187,000	225,000,000
1911	199,319	225,000,000	1128	10,681	21,000,000	1966	210,000	246,000,000
1912	356,000	335,000,000	941	22,000	43,000,000	1954	378,000	378,000,000
1913	461,500	399,902,000	866	23,500	44,000,000	1872	485,000	443,902,000
1914	548,139	420,838,378	768	24,900	44,219,096	1775	573,039	465,057,474
1915	895,930	575,978,000	643	74,000	125,800,000	1700	969,930	701,778,000
1916	1,525,578	921,378,000	604	92,130	161,000,000	1747	1,617,708	1,082,378,000
1917	1,745,792	1,053,505,781	603	128,157	220,982,668	1724	1,873,949	1,274,488,449
1918	943,436	801,937,925	850	227,250	434,168,992	1910	1,170,686	1,236,106,917
1919	1,651,625	1,365,395,415	827	224,731	371,422,820	1652	1,876,356	1,736,818,235
1920	1,905,560	1,809,170,963	949	321,789	423,249,410	1315	2,227,349	2,232,420,373
1921	1,468,067	1,038,191,037	707	148,052	166,070,810	1122	1,616,119	1,204,261,847
1922	2,274,185	1,494,513,991	657	269,991	226,049,658	837	2,544,176	1,720,563,649
1923	3,624,717	2,196,272,116	606	409,295	308,537,929	754	4,034,012	2,504,810,045
1924	3,185,881	1,970,096,559	618	416,659	318,580,580	765	3,602,540	2,288,677,139
1925	3,735,171	2,458,370,026	658	530,659	458,400,277	864	4,265,830	2,916,770,303
1926	3,783,987	2,640,064,519	698	316,947	452,123,435	875	4,300,934	3,092,187,954
1927	2,936,533	2,164,670,891	737	464,793	420,130,624	904	3,401,326	2,584,801,515
1928	3,815,417	2,576,489,623	675	543,342	437,132,258	804	4,358,759	3,013,621,881
1929	4,587,400	2,847,118,562	621	771,020	566,029,644	734	5,358,420	3,413,148,206
1930	2,784,745	1,645,398,523	591	571,241	389,436,690	682	3,355,986	2,034,835,213
1931	1,973,090	1,111,273,774	563	416,648	262,417,542	630	2,389,738	1,373,691,316
1932	1,135,491	618,291,168	544	235,187	136,193,336	579	1,370,678	754,484,504
1933	1,573,512	762,736,512	485	346,545	186,069,314	537	1,920,057	948,805,826
1934	2,177,919	1,147,116,195	527	575,192	320,143,667	556	2,753,111	1,467,259,862
1935	3,252,244	1,709,425,904	526	694,690	379,407,751	546	3,946,934	2,088,833,655
1936	3,669,528	2,015,646,217	549	784,587	462,820,474	590	4,454,115	2,478,466,691
1937*	3,915,889	2,304,349,252	588	893,085	542,921,096	608	4,808,974	2,847,270,348
1938*	2,000,985	1,269,765,050	634	488,100	339,226,639	695	2,489,085	1,608,991,689
1939*	2,866,796	1,816,434,914	634	710,496	502,421,776	707	3,577,292	2,318,856,690
1940*	3,692,328	2,422,491,461	656	777,026	593,731,603	764	4,469,354	3,016,223,064
1941*	3,744,300	2,615,697,373	698	1,094,261	1,086,925,650	993	4,838,561	3,702,623,023
1942*	220,814	173,661,378	786	805,264	1,366,000,000‡	1696	1,026,078	1,539,661,378
1943*	No production		....	677,115	1,340,000,000‡	1980	677,115	‡1,340,000,000
1944*	No production		....	749,488	1,500,000,000‡	2000	749,488	‡1,500,000,000

*—Includes Federal excise taxes and standard equipment.
†—A substantial part of the trucks reported comprise chassis only; hence the value of bodies for these chassis is not included.
‡—Estimated.

PASSENGER CAR AND TRUCK PRODUCTION, U. S. PLANTS



Truck Trailer Production—1939-1944

Type of Trailer	1939*	1940*	1941*
General Freight	20,089	23,685	38,356
Low-Bed Heavy Haulers	839	1,000	1,266
Pole and Logging	3,645	4,465	6,462
Dumps	816	819	1,656
Petroleum Tanks	1,325	1,810	2,311
Milk Tanks	103	147	196
Miscellaneous Tanks	114	155	201
Total	26,931	32,081	50,488

	1942			1943		
	Civilian	Military	Total	Civilian	Military	Total
January	1,387	2,023	3,410	556	11,785	12,341
February	946	1,738	2,684	925	8,767	9,692
March	1,245	2,197	3,442	430	10,915	11,345
April	936	3,221	4,157	567	11,471	12,038
May	1,151	4,385	5,536	611	10,487	11,098
June	1,318	4,814	6,132	1,267	14,941	16,208
July	411	4,741	5,152	698	16,866	17,564
August	294	8,861	9,155	792	16,772	17,564
September	227	10,614	10,841	477	19,811	20,288
October	259	8,170	8,429	420	21,456	21,876
November	138	10,045	10,183	518	22,264	22,782
December	96	10,711	10,807	793	23,276	24,069
Total	8,408	71,520	79,928	8,054	188,811	196,865

		CIVILIAN								
1944	Total Military	Total Civilian	General Freight	Pole and Logging	Low Bed Heavy Haulers	Milk Tanks	Petroleum Tanks	Off Highway	Miscel-laneous	Total-All Trailers
January	32,316	765	601	105	12	4	39	....	4	33,081
February	30,718	1,035	716	52	5	56	121	77	8	31,753
March	25,997	802	510	112	8	7	127	17	21	26,799
April	12,886	1,124	843	91	14	12	129	14	21	14,010
May	12,089	2,592	2,309	101	18	29	87	10	38	14,681
June	9,698	1,750	1,490	129	36	6	53	29	7	11,448
July	7,162	1,624	1,416	120	20	7	50	7	4	8,786
August	9,046	1,397	1,132	115	30	21	55	41	3	10,443
September	9,591	4,447	3,782	443	31	34	87	33	37	14,038
October	11,445	3,185	2,558	244	24	20	184	15	140	14,630
November	11,540	2,523	2,166	226	17	13	32	38	31	14,063
December	12,861	2,848	2,299	362	41	36	39	30	41	15,709
Total	185,349	24,092	19,822	2,100	256	245	1,003	311	355	209,441

*—Covers exclusively the highway civilian-type truck trailers and does not include those trailers with a rated tonnage capacity under 5 tons and those produced on direct military contract. Therefore not directly comparable with production data for 1942, 1943 and 1944.

Source—Automotive Division, War Production Board.

Truck and Truck Tractor Production—1936-1944
Civilian and Military

	TOTAL All Weights			LIGHT Under 9000 lb. G.V.W.			MEDIUM 9,000 to 15,999 lb. G.V.W.			HEAVY 16,000 lb. and Over		
	Civilian	Military	Total	Civilian	Military	Total	Civilian	Military	Total	Civilian	Military	Total
1936	770,629	2,725	773,354	317,189	1,004	318,193	417,395	1,125	418,520	36,045	596	36,641
1937	872,118	1,703	873,821	396,326	368	396,694	437,525	1,266	438,791	38,267	69	38,336
1938	478,307	2,248	480,555	208,575	690	209,265	248,886	1,119	250,005	20,846	439	21,285
1939	685,296	6,188	691,484	306,098	1,651	307,749	343,190	2,900	346,090	36,008	1,637	37,645
1940	700,101	55,389	755,490	337,983	13,365	351,348	323,088	36,042	359,130	39,030	5,982	45,012
1941	823,205	218,657	1,041,862	367,467	72,164	439,631	408,367	128,170	536,537	47,371	18,323	65,694
1942	125,294	671,633	796,927	23,427	277,413	300,840	86,072	169,188	255,260	15,795	225,032	240,827
1943	2,888	672,614	675,502	0	268,438	268,438	179	154,808	154,987	2,709	249,368	252,077
1944	119,081	624,669	743,750	0	247,113	247,113	87,990	87,380	175,370	31,091	290,176	321,267
1944												
January	2,528	56,068	58,596	0	21,479	21,479	1,985	12,806	14,791	543	21,783	22,326
February	2,766	52,905	55,671	0	21,095	21,095	1,798	9,940	11,738	968	21,870	22,838
March	4,628	51,731	56,359	0	21,081	21,081	3,317	8,303	11,620	1,311	22,347	23,658
April	8,151	47,568	55,719	0	19,481	19,481	6,245	6,649	12,894	1,906	21,438	23,344
May	9,298	47,622	56,920	0	19,338	19,338	7,310	7,007	14,317	1,988	21,277	23,265
June	11,926	49,260	61,186	0	20,830	20,830	9,319	6,625	15,944	2,607	21,805	24,412
July	11,243	50,297	61,540	0	20,269	20,269	8,582	6,031	14,613	2,661	23,997	26,658
August	12,511	56,034	68,545	0	23,441	23,441	10,248	5,746	15,994	2,263	26,847	29,110
September	12,277	52,765	65,042	0	21,367	21,367	10,034	6,300	16,334	2,243	25,098	27,341
October	13,075	51,054	64,129	0	18,534	18,534	9,432	6,144	15,576	3,643	26,376	30,019
November	14,677	54,336	69,013	0	19,765	19,765	10,153	6,503	16,656	3,524	28,068	32,592
December	16,001	55,029	71,030	0	20,433	20,433	9,567	5,326	14,893	6,434	29,270	35,704

Source—War Production Board, Automotive Division. These data cover actual production of trucks for civilian and military uses. They differ from the "factory sales" figures accepted as an index of production before the war. Jeeps, military ambulances and wheel drive personnel carriers are included; half-tracks, armoured cars and integral buses are excluded.

Bus Deliveries, Civilian and Military—By Months, 1942-1944

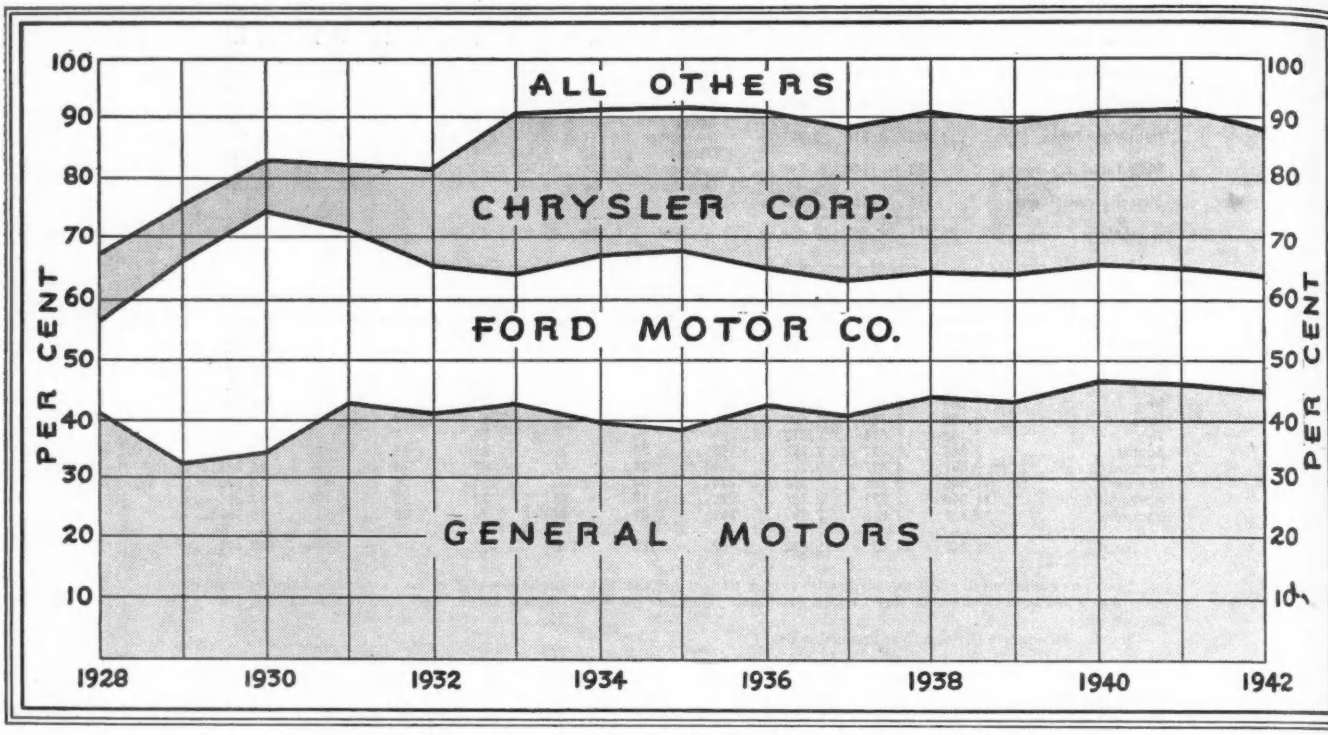
1942	Integral Buses	Body-on-Chassis Type	Total All Buses
January	901	240	1,141
February	828	284	1,112
March	929	327	1,256
April	875	444	1,319
May	938	756	1,694
June	875	679	1,554
July	879	563	1,442
August	263	625	888
September	557	607	1,164
October	376	286	662
November	419	373	792
December	497	529	1,026
Total	8,337	5,713	14,050

1943	Integral Buses	Body-on-Chassis Type	Total All Buses
January	227	187	414
February	226	309	535
March	102	185	287
April	76	201	277
May	33	245	278
June	54	332	386
July	15	576	591
August	48	465	513
September	145	542	687
October	162	531	693
November	199	562	761
December	326	505	831
Total	1,613	4,640	6,253

1944	Integral Buses	Body-on-Chassis Type	Total All Buses
January	231	444	675
February	245	293	538
March	336	253	589
April	352	232	584
May	367	405	772
June	293	560	853
July	381	847	1,228
August	470	1,241	1,711
September	563	982	1,545
October	594	1,030	1,624
November	484	1,111	1,595
December	1,483	1,124	2,607
Total	5,799	8,522	14,321

Note—Integral Buses are those in which body and chassis are built as one integrated unit Source—W.P.B., Transportation Equipment Division.

NEW CAR REGISTRATIONS BY MANUFACTURING GROUPS



12-Year Record of New Car Sales by Makes

(New Passenger Car Registrations by Makes—by Years)*

Make of Car	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	3 Mos. 1942‡
Chrysler	52,650	26,016	28,677	28,052	40,536	58,698	91,622	46,184	63,956	100,117	143,025	3,700
De Soto	28,430	25,311	21,260	11,447	26,952	45,068	74,424	35,259	51,951	71,943	91,004	2,585
Dodge	53,090	28,111	86,062	90,139	178,770	248,518	255,258	104,881	176,585	197,252	215,563	6,597
Plymouth	94,289	111,926	249,667	302,557	382,985	499,580	462,268	286,241	348,807	440,093	452,187	13,740
Total—Chrysler Corporation	228,459	191,364	385,666	432,195	629,243	851,884	883,572	472,565	641,299	809,405	901,779	26,622
Ford	528,581	258,927	311,113	530,528	826,519	748,554	765,933	363,688	481,496	542,755	602,013	17,666
Lincoln	3,466	3,179	2,112	2,061	2,370	15,567	25,243	16,991	19,940	21,004	18,769	937
Mercury	....	....	....	....	....	....	....	6,835	65,884	80,418	81,874	2,579
Total—Ford Motor Co.	532,047	262,106	313,225	532,589	828,889	764,121	791,176	387,514	567,320	644,177	702,656	21,182
Buick	90,873	49,708	43,809	63,067	87,635	160,687	205,297	166,380	218,995	295,513	308,615	9,641
Cadillac	11,136	6,269	3,903	4,899	6,692	11,766	11,231	10,639	13,090	21,965	60,242	2,196
Chevrolet	583,429	322,860	474,493	534,906	656,698	930,250	768,040	464,337	598,341	853,529	880,346	25,201
La Salle	6,883	3,848	3,709	5,182	11,775	13,992	28,909	15,732	22,197	16,599	....	....
Oakland	12,985	....	....	....	....	....	....	....	....	....	....	....
Oldsmobile	46,983	24,128	35,295	71,676	149,375	178,488	188,306	92,398	146,412	201,256	230,367	6,557
Pontiac	73,148	47,926	85,348	72,645	140,122	171,669	212,403	98,399	159,836	235,815	286,123	8,020
Total—General Motors Corp.	825,437	454,739	646,557	752,375	1,052,297	1,466,852	1,414,186	847,885	1,158,871	1,624,677	1,765,693	51,615
Auburn	29,536	11,646	5,038	5,536	5,163	1,848	146	....	....	....	....	....
Bantam (Austin)	2,941	....	3,675	1,057	....	....	....	700	1,227	800	138	....
Continental	....	....	3,310	953	....	....	....	....	....	....	....	....
Cord	1,416	335	....	....	....	1,174	1,149	....	....	....	....	....
De Vaux	4,808	1,358	....	....	....	....	....	....	....	....	....	....
Durant	7,229	1,135	....	....	....	....	....	....	....	....	....	....
Franklin	3,881	1,829	1,329	360	....	....	....	....	....	....	....	....
Graham	19,209	12,858	10,128	12,887	15,965	16,439	13,984	4,139	3,660	1,856	544	....
Hudson	19,189	8,641	2,946	19,307	21,587	20,825	90,043	40,889	62,855	79,979	73,261	2,963
Hupmobile	17,427	10,794	6,726	6,566	7,450	1,556	403	1,020	907	211	103	....
La Fayette	....	....	....	9,301	17,445	....	....	....	....	....	....	....
Marmon	5,687	1,365	86	....	....	....	....	....	....	....	....	....
Nash	39,366	20,233	11,353	14,315	17,739	43,070	70,571	31,814	54,050	52,853	77,824	2,876
Packard	16,256	11,058	9,081	6,552	37,653	68,772	95,455	49,163	62,005	73,794	69,653	2,602
Pierce-Arrow	4,522	2,692	2,152	1,740	875	787	167	17	....	....	....	....
Reo	6,762	3,870	3,623	3,854	3,894	3,146	....	....	....	....	....	....
Rockne	2	16,966	14,554	....	....	....	....	....	....	....	....	....
Studebaker	46,533	25,002	21,688	41,560	39,573	67,835	70,048	41,504	84,660	102,281	114,331	4,662
Terraplane (Essex)	42,545	28,778	35,831	40,510	53,838	78,471	†	†	†	....	....	....
Willys and Whippet	42,936	22,483	15,314	6,576	10,439	12,423	51,411	13,012	14,734	21,418	22,102	648
Willys-Knight	8,405	3,415	353	....	....	....	....	....	....	....	....	....
Miscellaneous	3,548	3,732	1,159	324	1,858	5,294	1,441	799	1,789	4,454	3,082	107
Total—All Other Makes	322,198	188,190	148,346	171,398	233,479	321,640	394,818	183,057	285,887	337,646	361,038	13,856
Total—All Makes	1,908,141	1,096,399	1,493,794	1,888,557	2,743,908	3,404,497	3,483,752	1,891,021	2,653,377	3,415,905	3,731,166	113,275

*—R. L. Polk & Co. data. †—Included with Hudson. ‡—Complete except for Connecticut for month of March.

Automotive Wholesalers, Dealers and Repair Shops—by Years*

(As of January of Each Year)

	Wholesalers	Passenger Car Dealers	Total Truck Dealers	Car and Truck Dealers	Independent Repair Shops	All Retail Outlets
1928	3,796	27,571	......	23,869	37,615	105,338
1929	3,912	27,403	......	24,068	43,863	111,329
1930	4,028	27,152	......	25,436	47,882	117,493
1931	4,668	......	......	48,658	53,898	118,713
1932	5,051	......	25,952	43,708	58,045	108,147
1933	5,337	38,003	23,746	39,370	59,547	103,113
1934	5,430	34,069	......	35,265	65,064	102,456
1935	5,757	35,977	......	37,238	64,518	105,991
1936	5,905	39,769	23,045	41,201	60,574	105,579
1937	5,874	41,288	24,853	43,461	56,423	102,808
1938	5,934	43,747	27,248	46,224	51,709	101,053
1939	6,019	39,936	26,909	41,992	50,406	95,418
1940	6,176	39,258	24,575	41,870	49,091	93,764
1941	6,575	39,833	24,992	41,790	49,208	95,296
1942	6,631	38,748	32,291	40,537	47,552	93,022
1943	6,130	32,470	27,820	34,270	43,540	80,863
1944	6,101	31,200	......	33,000	42,166	78,550
1945	6,217	30,110	26,370	31,930	41,193	78,498

*—Trade List Department—Chilton Company.

Automotive Wholesalers, Dealers, and Repair Shops—by States

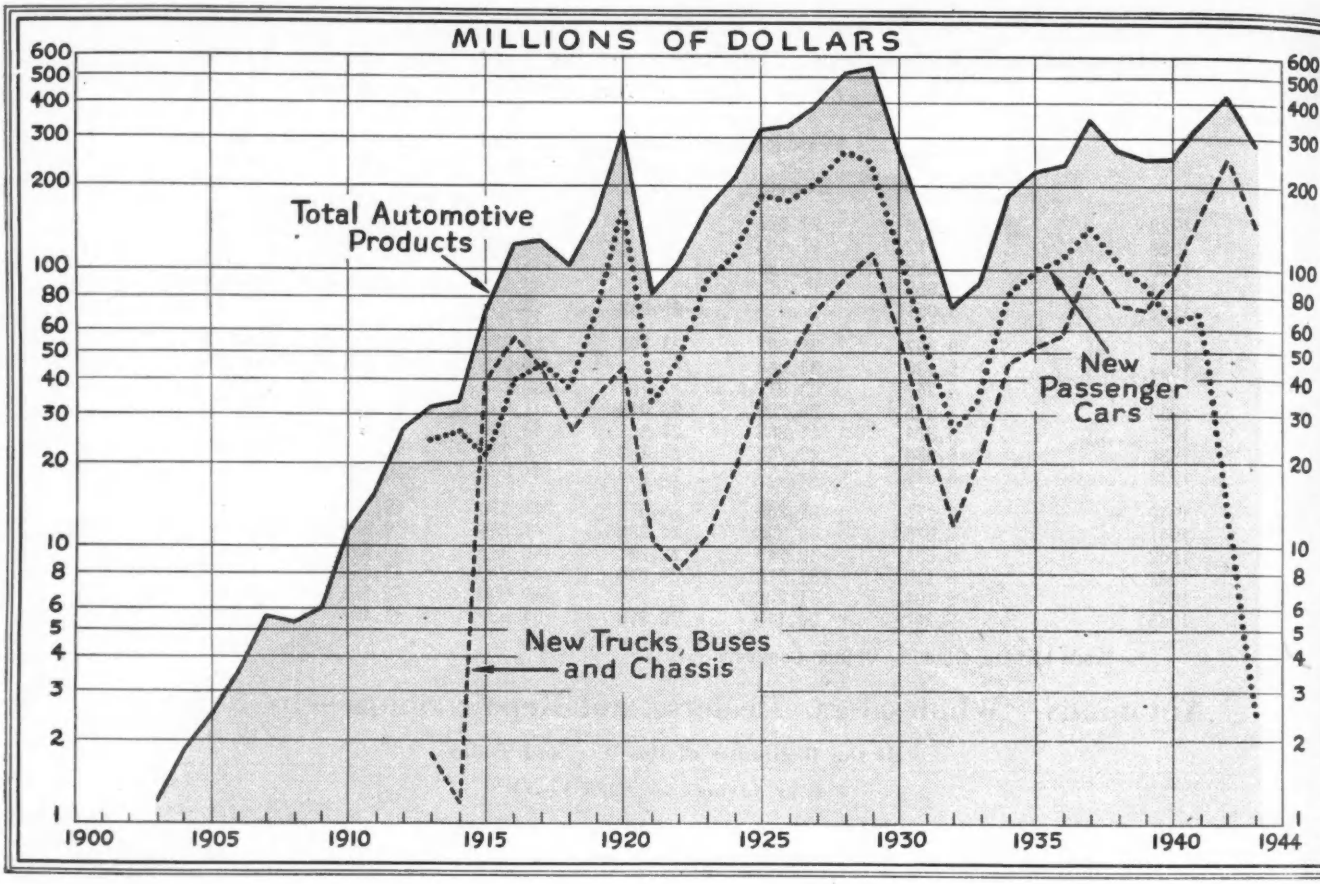
At the Beginning of the War and Today

(As of January of Each Year)

	Wholesalers		Passenger Car Dealers		Total Truck Dealers		Car and Truck Dealers		Independent Repair Shops		All Retail Outlets	
	1945	1942	1945	1942	1945	1942	1945	1942	1945	1942	1945	1942
Alabama	89	83	347	405	339	377	368	430	302	304	743	819
Arizona	34	33	113	147	105	142	120	157	134	144	279	330
Arkansas	84	80	310	363	304	343	334	381	313	306	694	703
California	503	535	1,383	1,881	1,233	1,578	1,457	1,966	3,692	4,921	5,635	7,510
Colorado	73	74	332	446	322	378	366	479	604	543	1,072	1,091
Connecticut	89	104	399	550	347	453	435	580	549	692	1,164	1,462
Delaware	14	14	59	72	49	64	61	75	82	73	178	173
District of Columbia	21	24	58	84	47	59	68	87	119	153	210	260
Florida	114	117	365	476	317	408	386	503	390	563	883	1,170
Georgia	95	104	477	579	441	499	506	599	283	374	846	1,028
Idaho	39	34	243	316	236	267	259	335	229	219	520	578
Illinois	384	416	1,793	2,270	1,486	1,862	1,899	2,381	2,695	2,852	4,801	5,579
Indiana	188	210	930	1,166	781	941	977	1,205	1,001	1,147	2,172	2,366
Iowa	171	174	998	1,359	952	1,214	1,081	1,459	1,085	1,185	2,246	2,835
Kansas	124	135	687	947	622	837	747	977	587	810	1,360	1,769
Kentucky	98	105	515	589	466	506	525	618	381	422	975	1,106
Louisiana	66	75	329	393	302	339	332	409	299	369	678	816
Maine	46	48	307	352	274	302	325	364	445	410	761	750
Maryland	66	83	370	457	317	389	387	471	389	446	821	950
Massachusetts	194	223	872	1,071	675	791	917	1,099	1,052	1,154	2,189	2,493
Michigan	255	255	1,369	1,791	1,155	1,492	1,441	1,840	1,723	1,823	3,485	4,035
Minnesota	129	128	989	1,379	855	1,163	1,010	1,412	1,494	1,647	2,579	3,245
Mississippi	67	76	322	391	306	345	347	420	200	199	562	622
Missouri	202	218	808	1,011	696	775	870	1,041	1,150	1,336	2,198	2,512
Montana	46	49	283	365	277	357	314	401	253	563	596	658
Nebraska	85	96	505	662	468	600	534	692	580	720	1,197	1,491
Nevada	10	10	63	81	62	85	70	88	84	94	172	196
New Hampshire	27	26	180	219	158	188	190	229	185	250	384	488
New Jersey	177	191	815	1,043	654	787	866	1,099	1,485	1,751	2,536	2,983
New Mexico	40	36	136	171	140	173	149	180	160	140	352	338
New York	456	521	2,132	2,788	1,767	2,215	2,275	2,909	4,244	5,078	6,855	8,481
North Carolina	134	132	612	745	534	606	655	766	480	485	1,202	1,331
North Dakota	31	24	350	476	324	428	353	495	393	468	807	1,001
Ohio	323	383	1,557	2,188	1,300	1,695	1,639	2,282	2,020	2,300	3,927	4,809
Oklahoma	115	138	522	663	488	619	554	713	722	805	1,529	1,690
Oregon	86	88	345	451	315	372	368	474	775	863	1,239	1,427
Pennsylvania	426	442	2,439	3,041	2,017	2,356	2,585	3,182	3,670	3,724	6,722	7,349
Rhode Island	26	29	115	163	96	115	122	167	139	206	290	402
South Carolina	55	58	307	389	259	318	298	404	202	245	510	608
South Dakota	34	32	297	394	288	356	324	411	266	326	622	756
Tennessee	99	111	388	475	345	408	402	496	366	401	819	935
Texas	367	372	1,484	1,850	1,315	1,625	1,625	1,985	2,118	2,684	3,925	4,816
Utah	47	44	159	194	159	175	179	208	253	242	479	485
Vermont	19	28	151	195	144	177	163	209	228	282	399	507
Virginia	90	86	603	684	519	526	627	707	654	645	1,334	1,449
Washington	135	141	513	731	468	613	556	769	1,097	1,295	1,876	2,146
West Virginia	70	79	376	478	336	391	412	504	288	345	755	889
Wisconsin	147	142	1,247	1,616	1,120	1,410	1,289	1,678	1,125	1,416	2,622	3,222
Wyoming	27	25	156	191	154	172	163	201	108	132	298	363
Total	6,217	6,631	30,110	38,748	26,370	32,291	31,930	40,537	41,193	47,552	78,498	93,022

Source—Trade List Department—Chilton Company.

DOLLAR VOLUME OF U. S. AUTOMOTIVE EXPORTS



U. S. Exports of Motor Vehicles, 1903-1943

In Units and Their Value and Including Lend-Lease

	PASSENGER CARS			TRUCKS, BUSES AND CHASSIS			TOTAL MOTOR VEHICLES		
	Number	Value	% of U. S. Production (No. of Units)	Number	Value	% of U. S. Production (No. of Units)	Number	Value	% of U. S. Production (No. of Units)
1903	....	$*1,207,065	....	....	$.........	....	....	$*1,207,065	....
1904	....	*1,895,605	....	....	....	....	....	*1,895,605	....
1905	....	*2,481,243	....	....	....	....	....	*2,481,243	....
1906	....	*3,497,016	....	....	....	....	....	*3,497,016	....
1907	**2,862	4,890,886	....	....	....	....	2,862	**4,890,886	....
1908	**2,477	4,656,991	....	....	....	....	2,477	**4,656,991	....
1909	**3,184	5,387,021	....	....	....	....	3,184	**5,387,021	....
1910	**6,926	9,548,700	....	....	....	....	6,926	**9,548,700	....
1911	**11,803	12,965,049	....	....	....	....	11,803	**12,965,049	....
1912	**21,757	21,550,139	....	....	....	....	21,757	**21,550,139	....
1913	24,293	24,275,793	5.3	993	1,737,141	4.2	25,286	26,012,934	5.2
1914	28,306	25,392,963	5.2	784	1,181,611	3.1	29,090	26,574,574	5.0
1915	23,880	21,113,956	2.7	13,996	39,140,682	18.9	37,876	60,254,638	3.9
1916	56,234	40,660,263	3.7	21,265	56,805,548	23.0	77,499	97,465,811	4.8
1917	64,808	48,612,632	3.7	15,977	42,343,502	12.5	80,785	90,956,134	4.3
1918	36,936	36,278,292	3.9	10,308	26,814,952	4.5	47,244	63,093,244	4.0
1919	67,145	73,700,527	4.1	15,585	35,425,437	6.9	82,730	109,125,964	4.4
1920	142,508	165,255,921	7.5	29,136	46,775,781	9.1	171,644	212,031,702	7.7
1921	30,950	32,533,725	2.1	7,840	10,335,893	5.3	38,790	42,869,618	2.4
1922	66,791	51,049,816	2.9	11,443	8,270,708	4.2	78,234	59,320,524	3.0
1923	127,035	90,692,272	3.5	24,859	15,317,136	6.1	151,894	106,009,408	3.7
1924	151,380	112,534,729	4.7	27,352	19,199,344	6.6	178,732	131,734,073	4.9
1925	244,306	184,885,830	6.5	58,625	37,703,402	11.0	302,931	222,589,232	7.1
1926	238,540	176,432,157	6.3	66,880	47,176,107	21.1	305,420	223,608,264	7.1
1927	278,748	207,966,456	9.5	105,447	70,123,600	22.7	384,195	278,090,056	11.2
1928†	375,428	269,393,369	9.8	140,191	93,006,070	25.8	515,619	362,399,439	11.8
1929	346,630	239,334,000	7.5	197,872	112,607,985	25.6	544,502	351,941,985	10.1
1930	159,464	110,355,978	5.7	85,666	56,861,119	14.9	245,130	167,217,097	7.3
1931	86,437	52,851,585	4.3	49,415	26,210,975	11.8	135,852	79,062,560	5.6
1932	44,282	25,502,047	3.8	25,532	12,142,681	10.8	69,814	37,644,728	5.1
1933	67,355	33,945,464	4.2	44,103	20,691,338	12.7	111,458	54,636,802	5.8
1934	148,387	80,604,563	6.8	93,766	45,125,359	16.3	242,153	125,729,922	8.7
1935	179,470	99,342,411	5.5	100,668	51,995,938	14.4	280,138	151,338,349	7.0
1936	186,542	107,483,285	5.1	108,167	56,765,713	13.7	294,709	164,248,998	6.6
1937	237,719	140,638,203	6.0	169,076	102,889,939	18.9	406,795	243,528,142	8.4
1938	167,693	104,628,982	8.4	117,943	74,451,986	24.1	285,636	179,080,968	11.4
1939	143,909	87,171,300	5.0	116,913	71,422,015	16.4	260,822	158,593,315	7.2
1940	97,586	63,766,211	2.6	107,040	91,324,669	13.7	204,626	155,090,880	4.5
1941	92,210	69,077,198	2.4	153,094	154,101,500	13.9	245,304	223,178,698	5.0
1942	13,951	13,199,744	‡	156,346	258,256,404	....	170,297	271,455,748	....
1943	2,092	2,424,583	‡	74,881	145,838,138	....	76,973	148,262,721	....

*—Includes motor vehicles and parts.
**—Includes all types of motor vehicles.
†—From 1928 through 1941 exports include shipments to non-contiguous territories.
Note—Prior to 1931 figures include used vehicles, but the effect of these used vehicles on per cent of production is negligible.
‡—Taken from stock piles.

(For additional automotive statistics see pages 70, 72, 74, 76 and 78)

AVIATION STATISTICS

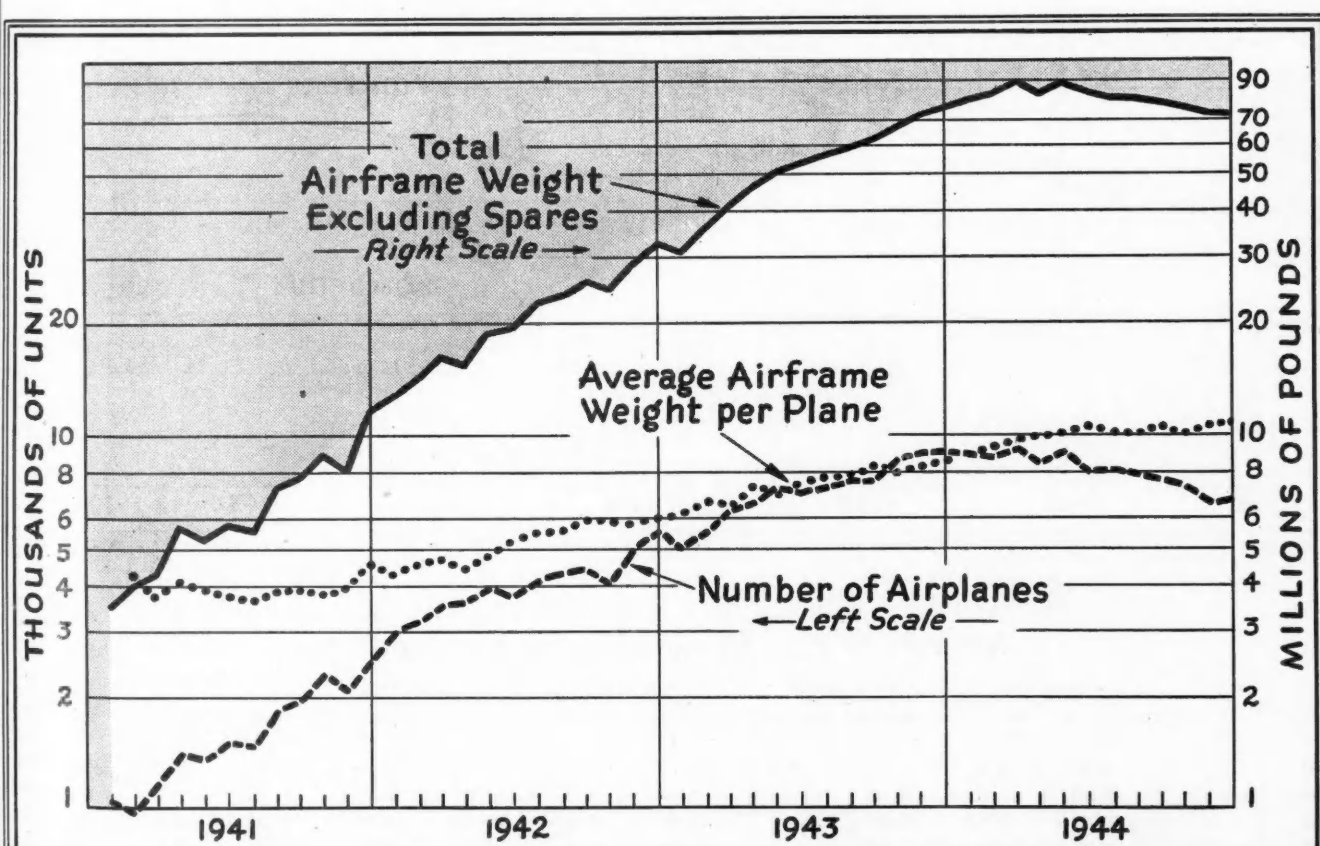
Aircraft Acceptances and Airframe Weights, by Months, 1941-1944

1941	Number Accepted	Airframe Weight Millions of Pounds: Excluding Spares	Airframe Weight Millions of Pounds: Including Spares	Average Weight per Airframe (lb.)
January	1,016	3.5	85.7	3,444
February	962	4.0	3.9	4,158
March	1,135	4.2	4.4	3,700
April	1,388	5.6	4.6	4,034
May	1,331	5.2	6.2	3,906
June	1,477	5.6	5.8	3,791
July	1,461	5.4	6.1	3,696
August	1,853	7.1	5.8	3,831
September	1,914	7.6	7.8	3,970
October	2,273	8.7	8.7	3,827
November	2,051	8.0	10.3	3,900
December	2,429	11.2	9.3	4,610
Total	19,290	76.1	12.8	3,945*
1943				
January	5,013	30.3	35.9	6,044
February	5,453	35.5	41.4	6,510
March	6,264	41.0	47.3	6,545
April	6,472	45.6	52.7	7,279
May	7,114	50.5	57.3	7,098
June	7,094	53.6	62.1	7,555
July	7,373	56.0	63.7	7,595
August	7,612	59.5	69.1	7,816
September	7,598	61.4	71.2	8,081
October	8,362	66.7	76.1	7,976
November	8,789	71.2	80.5	8,101
December	8,802	74.6	85.7	8,475
Total	85,946	645.9	743.0	7,515*

1942	Number Accepted	Airframe Weight Millions of Pounds: Excluding Spares	Airframe Weight Millions of Pounds: Including Spares	Average Weight per Airframe (lb.)
January	2,980	12.6	14.4	4,228
February	3,099	14.0	15.8	4,517
March	3,497	16.0	18.8	4,575
April	3,501	15.3	18.6	4,370
May	3,989	19.0	21.6	4,763
June	3,734	19.4	23.1	5,195
July	4,109	22.3	25.5	5,427
August	4,281	23.5	27.3	5,489
September	4,307	25.7	30.1	5,967
October	4,063	24.1	28.1	5,931
November	4,812	28.2	31.4	5,860
December	5,501	33.0	37.9	5,998
Total	47,873	253.1	292.6	5,287*
1944				
January	8,789	78.5	90.0	8,931
February	8,760	81.4	94.6	9,292
March	9,117	89.1	101.4	9,772
April	8,343	82.4	96.4	9,876
May	8,902	89.8	102.4	10,087
June	8,049	84.4	97.8	10,485
July	8,000	80.5	93.9	10,062
August	7,939	79.7	93.9	10,039
September	7,597	78.9	90.0	10,385
October	7,429	75.4	87.8	10,149
November	6,747	71.6	81.7	10,612
December	6,697	71.5	80.8	10,676
Total	96,369	963.2	1110.7	9,995*

Source—Aircraft Resources Control Office, Aircraft Production Board. *—Annual Average.

AVERAGE WEIGHT PER PLANE INCREASES STEADILY



Aircraft Acceptances by Type of Aircraft

Type of Plane	1941 Number of Planes	1941 Airframe Weight (Millions of Pounds) Excluding Spares	1941 Including Spares	1942 Number of Planes	1942 Airframe Weight (Millions of Pounds) Excluding Spares	1942 Including Spares
Bombers	4,123	40.3	45.2	12,674	152.8	175.0
Fighters and Naval Reconnaissance	4,946	17.6	19.8	12,239	46.1	54.7
Transports	502	3.7	4.2	1,980	17.4	19.6
Trainers	9,348	14.3	16.2	17,646	34.7	40.7
Communication and Special Purpose	371	0.2	0.3	3,334	2.1	2.6
Total	19,290	76.1	85.7	47,873	253.1	292.6

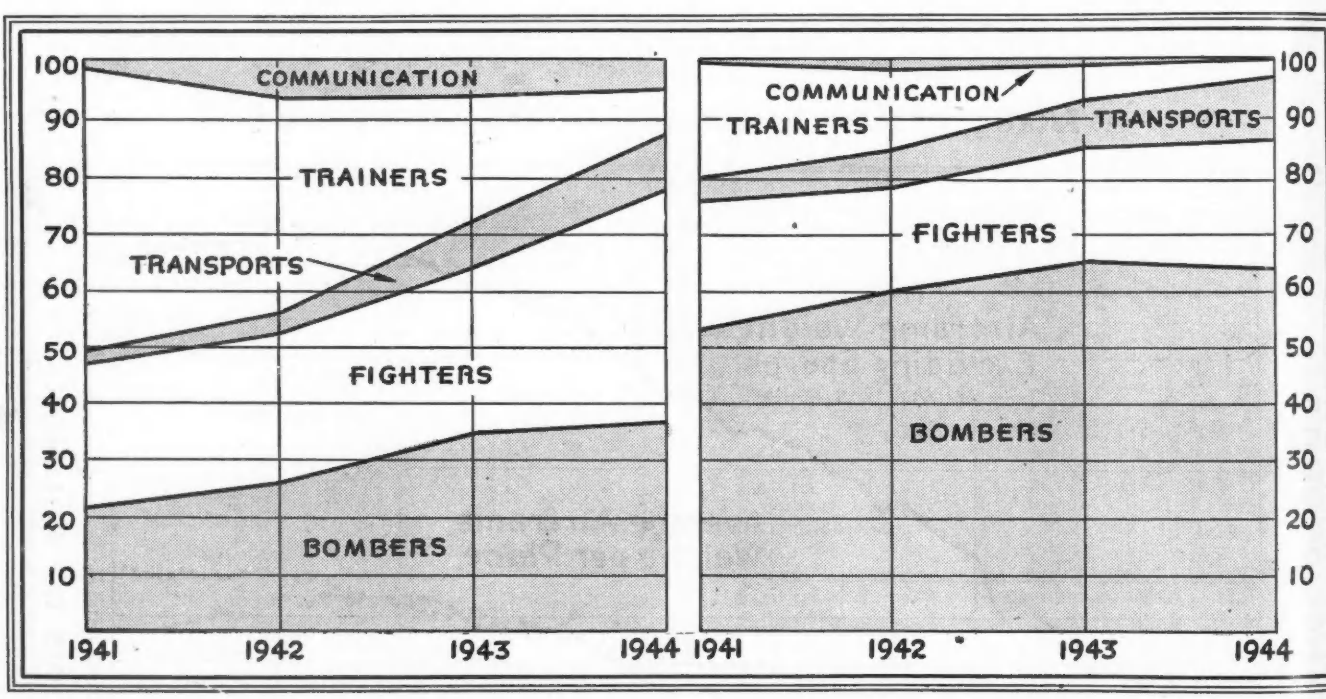
Type of Plane	1943 Number of Planes	1943 Airframe Weight (Millions of Pounds) Excluding Spares	1943 Including Spares	1944 Number of Planes	1944 Airframe Weight (Millions of Pounds) Excluding Spares	1944 Including Spares
Bombers	29,738	423.3	478.4	35,010	610.3	688.8
Fighters and Naval Reconnaissance	24,731	122.8	146.9	39,141	216.1	260.8
Transports	7,270	54.1	62.0	9,854	113.6	129.1
Trainers	19,306	42.4	51.5	7,581	19.2	27.1
Communication and Special Purpose	4,901	3.3	4.2	4,783	4.0	4.9
Total	85,946	645.9	743.0	96,369	963.2	1110.7

Source—Aircraft Resources Control Office, Aircraft Production Board.

AIRCRAFT ACCEPTANCES BY TYPE OF PLANE

IN PER CENT OF

TOTAL UNITS AND TOTAL AIRFRAME WEIGHTS



Aircraft Engine Production by HP Capacity

	Under 300 Hp. Number Produced	Under 300 Hp. Per Cent of Total	300 to 1000 Hp. Number Produced	300 to 1000 Hp. Per Cent of Total	1000 to 1600 Hp. Number Produced	1000 to 1600 Hp. Per Cent of Total	1600 and Over Hp. Number Produced	1600 and Over Hp. Per Cent of Total	Total Produced	Per Cent of Total	Total Take-off Hp. of Units Produced*
1941	12,341	24.35	11,481	22.65	17,710	34.94	9,152	18.06	50,684	100.00	50,900,000
1942	25,350	18.54	20,191	14.76	61,209	44.75	30,017	21.95	136,767	100.00	165,700,000
1943	30,218	13.34	22,658	10.00	127,200	56.14	46,485	20.52	226,561	100.00	336,700,000
1944	10,787	4.21	13,253	5.16	146,645	57.16	85,888	33.47	256,571	100.00	431,300,000

Source—Aircraft Resources Control Office, Aircraft Production Board. *—Includes Spare Parts.

Monthly Aircraft Engine Shipments and HP Produced, 1941-1944

1941	Number of Engines	Horsepower (In Millions) Excluding Spares	Horsepower (In Millions) Including Spares	Average Hp Per Engine	Horsepower Per Airplane
January	2,680	2.3	2.5	858	2,264
February	2,961	2.6	2.9	878	2,703
March	3,304	3.0	3.3	908	2,643
April	3,552	3.3	3.6	929	2,377
May	3,515	3.3	3.7	939	2,479
June	3,873	3.4	3.7	878	2,301
July	4,370	4.2	4.6	961	2,875
August	4,706	4.3	4.8	914	2,320
September	4,910	4.3	4.8	876	2,565
October	4,936	4.5	4.9	912	1,980
November	5,709	5.4	6.0	946	2,633
December	6,168	5.6	6.1	908	2,305
Total	50,684	46.2	50.9	911*	2,395*
1943					
January	16,011	17.4	21.4	1,087	3,471
February	15,328	16.2	20.3	1,057	2,971
March	16,930	19.4	23.8	1,146	3,097
April	16,838	18.6	24.2	1,104	2,874
May	17,869	19.7	25.7	1,102	2,769
June	17,735	20.0	26.4	1,128	2,819
July	18,753	21.3	28.5	1,136	2,889
August	19,688	23.2	30.0	1,178	3,048
September	20,585	24.9	31.9	1,210	3,277
October	21,856	26.2	33.6	1,199	3,133
November	22,680	27.4	35.3	1,208	3,117
December	22,288	27.8	35.6	1,247	3,158
Total	226,561	262.1	336.7	1,157*	3,050*

1942	Number of Engines	Horsepower (In Millions) Excluding Spares	Horsepower (In Millions) Including Spares	Average Hp Per Engine	Horsepower Per Airplane
January	7,140	7.0	7.7	980	2,349
February	7,349	7.1	7.5	966	2,291
March	8,969	8.6	9.1	959	2,459
April	9,973	9.7	10.4	972	2,771
May	10,795	10.6	11.4	982	2,657
June	11,750	11.8	12.8	1,004	3,160
July	11,872	12.5	14.1	1,053	3,042
August	12,891	13.7	16.4	1,063	3,200
September	13,238	13.9	17.3	1,050	3,227
October	13,683	15.4	18.0	1,125	3,790
November	14,181	15.6	19.9	1,100	3,242
December	14,926	16.7	21.1	1,119	3,036
Total	136,767	142.6	165.7	1,042*	2,979*
1944					
January	22,627	29.6	36.1	1,308	3,368
February	21,067	27.1	35.1	1,286	3,094
March	23,923	31.9	39.2	1,333	3,499
April	22,681	30.5	37.4	1,345	3,656
May	22,819	31.9	38.1	1,398	3,583
June	23,072	32.8	38.5	1,421	4,075
July	22,603	32.5	36.6	1,438	4,062
August	24,102	35.0	39.9	1,452	4,408
September	20,881	30.8	35.3	1,475	4,054
October	19,268	29.4	33.4	1,526	3,957
November	17,235	26.4	31.7	1,532	3,912
December	16,293	25.4	30.0	1;559	3,793
Total	256,571	363.3	431.3	1,416*	3,770*

Source—Aircraft Resources Control Office, War Production Board.

Airplane and Engine Production–1927-1943

In Units and Their Value

	Airplanes Number	Airplanes Value	Airplane Engines Number	Airplane Engines Value	Value of Spare Parts	Value of Parachutes, Pontoons and Propellers
1927	1,785	$7,187,460	1,400	$9,493,696	$5,037,519	$1,407,129
1928	4,346	43,411,000	3,496	19,916,000	(c)	1,336,000
1929	6,193	50,730,266	6,276	24,966,083	10,891,899	3,528,436
1930	3,437	37,333,736	4,356	17,267,795	7,211,992	3,904,394
1931	2,398	21,600,453	3,794	13,779,791	9,224,172	1,358,093
1932	1,396	15,287,789	1,959	8,902,808	4,231,495	1,497,516
1933	1,152	15,580,255	1,822	8,651,247	5,898,282	1,375,343
1934	1,615	25,399,000	2,545	15,825,000	(c)	2,668,000
1935	1,365	17,454,331	2,866	12,610,285	6,527,424	2,831,580
1936	3,006	47,531,565	4,295	26,383,055	(c)	4,234,273
1937	3,100	38,664,153	6,214	28,576,971	19,951,198	9,129,299
1938	2,698(a)	75,872,587	......	....	....	....
1939	3,770(a)	....	11,172	....	37,223,073	14,513,948
1940	12,636	544,000,000(b)	......	....	....	....
1941	19,290	820,000,000	50,684	496,000,000	308,000,000	99,000,000(d)
1942	47,873	2,769,000,000	136,767	1,618,000,000	1,350,000,000	307,000,000(d)
1943	85,946	6,856,000,000	226,561	2,818,000,000	2,984,000,000	626,000,000(d)
1944	96,369	10,079,000,000	256,571	3,939,000,000	3,800,000,000	796,000,000(d)

Source: Data from 1927 through 1940—Census of Manufacturers. For 1941 through 1944—Aircraft Production Board and War Production Board.

(a)—Production for civil use only.
(b)—Includes value of airplanes, engines and propellers and parts.
(c)—Included with value of airplanes.
(d)—Value of propellers only.

Note:—The number of airplanes produced and the value of their production pertain to only those airplanes on which production was started and completed during the year for years 1931 to date. The values of the engines, propellers and power plant accessories installed in the aircraft are not included in the values of the aircraft reported for 1931 and subsequent years. Data here presented do not show value of all work done by aircraft industry as it fails to take into consideration experimental work, work begun during a given year but not completed in that year, and all repair work.

British Production of Aircraft and Aircraft Engines

	1939 September through December	1940	1941	1942	1943	1944 January through June	Total Sept. 1939 through June 1944
Heavy bombers	....	41	498	1,976	4,614	2,889	10,018
Medium and light bombers	1,072	3,679	4,170	4,277	3,113	1,391	17,702
Fighters	477	4,283	7,063	9,850	10,727	5,655	38,025
Naval aircraft	165	476	1,232	1,082	1,720	1,533	6,208
Trainers	772	5,125	6,614	5,940	4,825	2,070	25,346
Reconnaissance, transport, air-sea rescue, etc.	468	1,445	516	546	1,264	1,071	5,310
Total new aircraft	2,924	15,049	20,093	23,691	26,263	14,609	102,609
Structure weight new aircraft (million lb.)	11.26	58.84	87.26	133.3	185.2	111.7	587.7
Aircraft engine output	4,532	24,074	36,551	53,916	57,985	31,643	208,701
HP of new engines*	2.9	17.4	31.4	59.4	72.8	41.9	225.9

* Millions of HP

Operation Statistics of Domestic Air Lines*

(Operating in Continental United States)

(As of December 31 of each year)

	1936	1937	1938	1939	1940	1941	1942	1943	1944
Operating companies, number of	21	17	18	17	16	17	16	16	16
Personnel employed	7,045	7,529	8,955	10,509	15,800	18,984	(1)26,447	30,349	....
Airplanes in service and reserve	272	282	253	265	358	359	179	194	279
Passenger seats per plane—average	10.67	12.53	13.63	14.63	16.52	17.41	17.60	17.61	....
Average speed, miles-per-hour	149	153	153	153	155	159	159	160	....
Miles flown, revenue	63,777,226	66,971,507	69,668,827	82,571,523	108,800,436	133,022,679	110,102,860	103,601,443	142,234,837
Passengers carried, total	1,020,931	1,102,707	1,343,427	1,876,051	2,959,480	4,060,545	3,551,833	3,454,040	3,967,628
Passenger miles flown(2) (000 omitted)	443,740	476,603	557,719	749,787	1,147,445	1,491,735	1,481,976	1,642,597	2,264,282
Express and freight carried (pounds)	6,928,777	7,127,369	7,335,967	9,514,229	12,506,176	19,209,671	39,968,765	57,543,591	65,916,837
Mail carried (ton miles)	5,741,436	6,698,230	7,422,860	8,584,891	10,035,638	12,900,405	21,066,627	35,927,042	50,825,202
Gasoline consumed, gallons	30,392,923	33,606,770	37,218,743	46,554,856	64,906,284	80,757,892	68,030,246	63,908,388	....
Oil consumed, gallons	675,655	629,127	644,768	726,507	1,087,208	1,258,983	989,103	878,923	....

*—Civil Aeronautics Administration. (1)—Estimated. (2)—One passenger one mile.

Number of U. S. Airports and Landing Fields*

(As of December 31 of each year)

	1936	1937	1938	1939	1940	1941	1942	1943	1944
Airports and landing fields									
Commercial	774	727	760	801	860	930	1,069	801	1,027
Municipal	1,037	1,053	1,092	963	1,031	1,086	1,129	914	1,067
Intermediate CAA—lighted	284	278	265	266	289	283	273	239	228
Intermediate CAA—unlighted	12	5	2	0	0	0	0	1	1
Army, Navy, Marine Corps, reserve, private and miscellaneous airports	235	236	255	250	151	185	338	814	1,104
Total airports in operation	2,342	2,299	2,374	2,280	2,331	2,484	2,809	2,769	3,427
Total lighted airports	705	720	719	735	776	662	700	859	964

*—Civil Aeronautics Administration.

Number of Certified Civil Aircraft and Pilots—By Years*

(As of December 31 of each year)

	1936	1937	1938	1939	1940	1941	1942	1943	1944
Certificated aircraft									
Airplanes	7,424	9,152	10,000	12,829	17,351	24,836	22,904	22,927	21,893
Glider	31	41	45	44	39	65	104	124	144
Certificated airmen									
Pilots, airplane, total	15,952	17,681	22,983	31,264	63,113	100,787	110,510	122,884	132,432
Airline transport	842	1,064	1,159	1,197	1,431	1,587	2,177	2,315	3,046
Commercial	7,288	6,411	7,839	8,280	10,151	15,429	18,808	20,587	22,059
Private	7,822	10,206	13,985	21,787	51,531	83,771	89,525	99,982	107,327
Pilots, glider	138	161	172	170	138	160	211	1,435	2,412
Mechanics	8,738	9,314	9,884	10,296	11,177	14,047	18,097	20,805	23,157
Parachute riggers	393	362	397	425	444	818	1,004	(c)	(c)
Ground instructors	48	55	92	446	1,948	4,815	7,604	12,739	14,647
Student pilot certificates issued (Yearly)									
Airplane	17,675	21,770	15,556	29,839	110,938	93,366	139,289	189,102	.....
Glider	209	125	98	263	419	385	486	1,137	1,211

*—Civil Aeronautics Administration. (c)—Ratings discontinued Jan. 21, 1944.

Box Score of the Army Air Forces*

A.A.F. Airplane Losses

Dec. 7, 1941—Dec. 31, 1944

Lost in Aerial Combat vs. Germany	6,989
Lost in Aerial Combat vs. Japan	1,296
Lost by Anti-Aircraft vs. Germany	5,002
Lost by Anti-Aircraft vs. Japan	440
Destroyed on Ground vs. Germany	92
Destroyed on Ground vs. Japan	354
Lost by Other Causes vs. Germany	2,663
Lost by Other Causes vs. Japan	994
Total	17,830

Enemy Airplane Losses

Dec. 7, 1941—Dec. 31, 1944

Destroyed in Aerial Combat	24,393
Prob. Destroyed in Aerial Combat	6,294
Damaged in Aerial Combat	8,569
Destroyed on Ground	7,153
Prob. Destroyed on Ground	730
Damaged on Ground	3,519
Total	50,658

Total Number of Sorties Flown by A.A.F.

Dec. 7, 1941—Dec. 31, 1942	26,900
Jan. 1, 1943—Dec. 31, 1943	364,910
Jan. 1, 1944—Dec. 31, 1944	1,271,784
Cumulative Total	1,663,594

* From Second Report of H. H. Arnold, Commanding General, Army Air Forces.

Total Tonnage of Bombs Dropped on Enemy Objectives by A.A.F.

Dec. 7, 1941—Dec. 31, 1942	10,203
Jan. 1, 1943—Dec. 31, 1943	194,755
Jan. 1, 1944—Dec. 31, 1944	1,082,818
Cumulative Total	1,287,776

(For U. S. Aeronautic Exports see page 84)

World Military Airplanes—*Grouped by Countries*

The following specifications of world military airplanes have been compiled from data furnished by authoritative sources. Airplanes of American and British manufacture have been confined to those in production during 1944. German, Italian, Japanese and Russian airplanes are those in current service. For older type airplanes see AUTOMOTIVE *and* AVIATION INDUSTRIES, March 15, 1944.

MAKE AND MODEL	Popular or Code Name	Type	Number of Crew	ENGINE: Number Used	ENGINE: Maximum Hp. at Altitude (Ft.)	ENGINE: Number of Cylinders	ENGINE: Make	DIMENSIONS: Span	DIMENSIONS: Length	DIMENSIONS: Height	DIMENSIONS: Wing Area (Sq. Ft.)	WEIGHTS: Empty	WEIGHTS: Loaded	PERFORMANCE: Maximum Speed (Mph) at Altitude (Ft.)	PERFORMANCE: Range in Miles at Mph at Cruising Speed	PERFORMANCE: Initial Climb (Ft. per Minute)	PERFORMANCE: Service Ceiling with Normal Load
UNITED STATES																	
Boeing B-17G	Flying Fortress	Bomber	8–10	4	1200 @	9	Wright	103′ 9 3/8″	74′ 9″	19′ 1″	1420.0	36,000	65,000	+300 @			40,000+
Boeing B-29	Superfortress	Bomber	8–13	4	2200 @	14	Wright	141′ 3″	99′ 0″	27′ 9″				+330 @			30,000+
Consolidated Vultee B-24	Liberator	Bomber	5–10	4	1200 @	14	Pratt & Whitney	110′ 0″	66′ 4″	18′ 0″	6575.0	34,933	+56,000	+300 @	4000 @		36,000
Consolidated Vultee PB2Y3	Coronado	Bomber	7	4	1200 @	14	Pratt & Whitney	115′ 0″	79′ 3″	27′ 6″		39,332	66,000	+200 @	2940 @		20,800
Consolidated Vultee PBY-5	Catalina	Bomber	5	2	1200 @	14	Pratt & Whitney	104′ 0″	63′ 10″	18′ 10 5/8″		17,564	35,000	196 @	4000 @		18,200
Douglas A-20h	Havoc	Bomber	3	2	1450 @ 12,000	14	Wright	61′ 4″	47′ 4″	18′ 1″	464.0	16,837	23,977	329 @	1275 @ 273	1750	24,300
Lockheed B-34	Ventura	Bomber	4	2	2000 @	18	Pratt & Whitney	65′ 6″	51′ 5″	11′ 11″	551.0	19,000	30,000	+300 @	1000 @		25,000+
Martin A-30A	Baltimore	Bomber	4	2	1350 @	14	Wright	61′ 4″	48′ 5 3/4″	14′ 2″	538.5	21,000	24,000	+300 @	1700 @		15,000
Martin B-26F-G	Marauder	Bomber	5–7	2	1600 @ 13,500	14	Pratt & Whitney	71′ 0″	56′ 6″	11′ 2″	659.0	23,668	31,325	+300 @	1800 @		25,200
Martin PBM-3D	Mariner	Bomber	11	2	1750 @	14	Wright	118′ 0″	80′ 0″	27′ 6″			56,000	+200 @	+3000 @		15,000+
North American B-25H	Mitchell	Bomber	5	2	1700 @ 4,500	14	Wright	67′ 7″	51′ 3 3/4″	16′ 4 1/16″	609.8	19,924	28,330	+300 @ 13,000			23,800
North American B-25J	Mitchell	Bomber	6	2	1700 @ 4,500	14	Wright	67′ 7″	53′ 5 3/4″	16′ 4 1/16″	609.8	19,480	27,000	+300 @ 13,000			25,500
Brewster SB2A-4	Buccaneer	Bomber	2	1	1700 @	14	Wright	47′ 0″	39′ 2 3/8″	10′ 10″		9,780	12,674	296 @	1680 @		28,000
Consolidated Vultee A-35	Vengeance	Bomber	2	1	1700 @	14	Wright	45′ 0″	40′ 0″	13′ 0″				250 @	+1500 @		20,000
Curtiss-Wright SB2C3, A-25	Helldiver	Bomber	2	1			Wright	49′ 8″	36′ 8″	15′ 1″		14,000					
Douglas A-24b	Dauntless	Bomber	2	1	900 @ 4,500	9	Wright	41′ 6″	33′ 0″		325.0	6,509	9,505	247 @	506 @	1550	24,540
Douglas SBD-6	Dauntless	Bomber	2	1	1300 @ 4,000	9	Wright	41′ 6″	33′ 0″		325.0	6,521	9,493	255 @	520 @	2038	26,450
Bell P-59A-1	Airacomet	Fighter	1	2		(a)	General Electric	45′ 6″	38′ 1″	12′ 0″	385.8	7,950	10,822	+400 @			40,000
Bell P-39Q	Airacobra	Fighter	1	1	1017 @ SL	12	Allison	34′ 0″	30′ 3/4″	12′ 3/4″	213.2	5,967	8,051	375 @ 9,000	1500 @	2000	32,000
Bell P-63, A-10	Kingcobra	Fighter	1	1	1325 @ SL	12	Allison	38′ 4″	32′ 8 3/8″	12′ 7″	248.0	6,693	8,442	+400 @			35,000
Brewster F3A1	Corsair	Fighter	1	1	2000 @	18	Pratt & Whitney	40′ 11 3/4″	33′ 4″	15′ 3 3/4″		8,789	11,089	+400 @	943 @		32,850
Chance Vought F4U-1D	Corsair	Fighter	1	1	2000 @	18	Pratt & Whitney	41′ 0″	33′ 4″	16′ 1″				+400 @	+1500 @		35,000+
Curtiss-Wright P-40N	Warhawk	Fighter	1	1	1200 @ SL	12	Allison	37′ 4″	33′ 4″	10′ 7″	236.0	6,194	8,343	+350 @	1000 @	2200	31,000
Douglas A-26	Invader	Fighter	1	2	2000 @		Pratt & Whitney										
Grumman F6F	Hellcat	Fighter	1	1	2000 @	18	Pratt & Whitney	42′ 10″	33′ 6 5/8″	13′ 0″							
Lockheed P-38L; F-5E	Lightning	Fighter	1	2	1500 @	12	Allison	52′ 0″	37′ 10″	9′ 10″	327.5	12,700	18,000	+425 @	1700 @		40,000+
North American P-51D	Mustang	Fighter	1	1	1600 @ 11,800	12	Rolls-Royce	37′ 5/16″	32′ 3 5/16″	12′ 2 1/16″	233.2	7,140	8,604	450 @	2000 @		40,000+
Northrop P-61	Black Widow	Fighter	2–3	2	2000 @	18	Pratt & Whitney	66′ 0″	48′ 9″	9′ 2″							
Republic P-47	Thunderbolt	Fighter	1	1	2000 @ 38,750	18	Pratt & Whitney	40′ 8″	36′ 1″	14′ 2″	300.0			+450 @			40,000
Beech F2		Reconnaissance	3	2	450 @ 5,000	9	Pratt & Whitney	47′ 8″	34′ 3″	9′ 4″	349.0	5,096	7,500	223 @	735 @ 194	1650	24,000+
Consolidated Vultee L5	Flying Jeep	Reconnaissance	2	1	190 @	..	Lycoming	34′ 0″	24′ 0″	7′ 1″		1,472	2,158	129 @			15,800
Piper L4		Reconnaissance	3	1	100 @ SL	4	Lycoming	35′ 5 1/2″	22′ 6″	6′ 10″	179.3	860	1,550	110 @ 3,000	238 @ 95	650	16,000
Sikorsky R-4	Helicopter	Reconnaissance			100 @	6	Franklin	38′	48′ 0″	12′ 0″			2,500				
Taylorcraft L2	Grasshopper	Reconnaissance	2	1	65 @ SL	4	Continental	35′ 5 1/4″	22′ 5″	7′ 0″	177.7	825	1,325	92 @ S.L.	227 @	455	12,000
Beech C-45A		Transport	5	2	450 @ SL	9	Pratt & Whitney	47′ 8″	34′ 3″	9′ 4″	349.0	5,056	7,500	223 @	735 @ 194	1650	24,000
Beech UC-43	Traveler	Transport	4	1	450 @ SL	9	Pratt & Whitney	32′ 0″	26′ 1 1/2″	8′ 0″	296.4	3,085	4,250	203 @	525 @ 171	1500	24,300
Boeing C-97		Transport	5	4	2200 @	18	Wright	141′ 3″	110′ 4″	33′ 3″	1738.9		120,000				30,000+
Consolidated Vultee C-87	Liberator Express	Transport	5	4	1200 @ SL	14	Pratt & Whitney	110′ 0″	66′ 4″	18′ 0″	6575.0	31,330	+60,000	+300 @	4000 @		36,000
Curtiss-Wright C-46	Commando	Transport	4	2	1600 @	18	Pratt & Whitney	108′ 1″	76′ 4″	21′ 9″	1360.0	30,456	45,000	265 @			24,500
Douglas C-54	Skymaster	Transport	4	4	1000 @ 12,300	..	Pratt & Whitney	117′ 6″	93′ 11″	27′ 6″	1462.0	36,400	62,000	280 @ 14,000	5100 @ 188	1070	22,500
Douglas C-47	Skytrain	Transport	2–3	2	1050 @ 7,000	..	Pratt & Whitney	95′ 0″	64′ 5 1/2″	16′ 11″	987.0	16,865	25,200	229 @ 8,800	2125 @ 208	1050	23,700
Douglas C-53	Skytrooper	Transport	4	2	1050 @ 7,000	..	Pratt & Whitney	95′ 0″	64′ 5 1/2″	16′ 11″	987.0	16,970	31,000	229 @ 8,900	2125 @ 185	1170	24,100
Fairchild C-82	Packet	Transport		2	2100 @	18	Pratt & Whitney	106′ 0″					50,000		+3500 @		
Fairchild UC-61K	Forwarder	Transport		1	200 @ SL	6	Ranger	36′ 4″	25′ 10 1/4″	7′ 7 1/2″	193.3	1,813	2,882	124 @	465 @ 112	650	12,700
Grumman JRF-5	Grey Goose	Transport	1	2	900 @	9	Pratt & Whitney	49′ 0″	38′ 4″	15′ 0″	375.0	5,878	8,038	200 @	640 @	1100	21,000
Grumman J4F-2	Widgeon	Transport	1	2	400 @	..	Ranger	40′ 0″	31′ 1″	11′ 5″	245.0	3,260	4,500	153 @	920 @	700	14,600
Lockheed C-69	Constellation	Transport	6	4	2200 @	18	Wright	123′ 0″	95′ 2″	23′ 8″	1650.0	50,100	86,250	+350 @			25,000+
Martin JRM-1	Mars	Transport	16	4	2200 @	18	Wright	200′ 0″	120′ 3″	44′ 7″			145,000	+200 @	+5000 @		15,000
Beech AT-10BH	Wichita	Trainer	2	2	295 @ SL	9	Lycoming	44′ 0″	32′ 2″	10′ 4″	298.0	4,749	6,000	200 @	765 @ 176	1150	19,800
Beech AT-11	Kansas	Trainer	4–5	2	450 @ SL	9	Pratt & Whitney	47′ 8″	34′ 1 7/8″	9′ 7 3/4″	349.0	6,158	8,727	216 @	565 @ 192	1125	20,000
Beech SNB-2	Navigator	Trainer	5	2	450 @ SL	9	Pratt & Whitney	47′ 8″	34′ 3″	9′ 4″	349.0	5,056	7,500	223 @	735 @ 194	1650	24,000
Boeing PT13D-N2S-5	Boeing Kaydet	Trainer	2	1	220 @ SL	9	Lycoming	32′ 2″	25′ 0″	9′ 5″	297.6	2,063	2,775	122 @	385 @ 76	710	12,800
Cessna AT-17	Bobcat	Trainer	1	2	225 @ SL	7	Jacobs	41′ 11″	32′ 9″	9′ 11″	295.0	4,000	5,700	180 @			16,000
Consolidated Vultee BT-13	Valiant	Trainer	2	1	450 @ SL	9	Pratt & Whitney	42′ 0″	28′ 10″	18′ 4″	239.0	3,345	4,360	166 @	516 @		17,900
Fairchild PT-19	Cornell	Trainer	2	1	175 @ SL	6	Ranger	36′ 11″	28′ 0″	7′ 6″	200.0	1,851	2,518	125 @ S.L.	430 @ 113	655	13,000
Fairchild PT-26	Cornell	Trainer	2	1	200 @ SL	6	Ranger	36′ 11″	28′ 0″	9′ 1 1/2″	200.0	2,022	2,741	126 @ S.L.	450 @ 114	675	17,300
Fairchild AT-21	Gunner	Trainer	2	2	520 @ SL	12	Ranger	52′ 0″	37′ 0″	13′ 1 1/2″	378.0	8,654	11,288	225 @ 12,000	910 @ 196	930	22,150
North American AT-6D, SNJ-5	Texan	Trainer	2	1	600 @ SL	9	Pratt & Whitney	42′ 1/4″	29′ 0″	11′ 9″	253.7	4,103	5,245	205 @ 5,000	750 @	1750	21,500
Ryan PT-22, NR-1	Recruit	Trainer	2	1	160 @ SL	5	Kinner	30′ 1″	22′ 5″	7′ 2″	134.3	1,272	1,825	129 @ S.L.	325 @	860	15,800
Timm N2T-1	Tutor	Trainer	2	1	220 @ SL	7	Continental	38′ 0″	25′ 1 5/8″	11′ 8 9/16″	184.9	1,940	2,725	135 @ S.L.	400 @ 115	875	15,000

(Continued on next page)

World Military Airplanes—*continued*

MAKE AND MODEL		Popular or Code Name	Type	Number of Crew	ENGINE: Number Used	ENGINE: Maximum Hp. at Altitude (Ft.)	ENGINE: Number of Cylinders	ENGINE: Make	DIMENSIONS: Span	DIMENSIONS: Length	DIMENSIONS: Height	DIMENSIONS: Wing Area (Sq. Ft.)	WEIGHTS: Landing	WEIGHTS: With Normal Load	PERFORMANCE: Maximum Speed (Mph) at Altitude (Ft.)	PERFORMANCE: Range in Miles at Mph at Cruising Speed	PERFORMANCE: Initial Climb (Ft. and Minutes)	PERFORMANCE: Service Ceiling with Normal Load
BRITISH																		
Avro	Mark III	Lancaster	Bomber	7	4		12	Merlin 28	102′ 0″	69′ 4″	20′ 0″	1297.0		60,000	275 @	3000 @		
Handley-Paige	Mark III	Halifax	Bomber	6	4	1650 @	14	Hercules XVI	104′ 0″	70′ 1″	20′ 9″							
Short	Mark III	Stirling	Bomber	7	4	1650 @	14	Hercules XVI	99′ 1″	87′ 3″	22′ 9″	1460.0		70,000	280 @	2050 @		
Vickers-Armstrongs	Mark X	Wellington	Bomber	6	2	1650 @	14	Hercules XVI	86′ 0″	60′ 10″	18′ 9″	830.0			255 @ 12,500	1470 @		22,000
De Haviland	Mark XVI	Mosquito	Bomber	2	2		12	Merlin 72 & 73	54′ 2″	44′ 6″	15′ 3″	454.0			+400 @	1500 @		+36,000
Fairey		Barracuda	Bomber	3	1		12	Merlin 32	49′ 2″	40′ 6″								
Vickers-Armstrongs	Mark XIV	Spitfire	Fighter	1	1	2000 @	12	Griffon 65	36′ 10″	32′ 7¾″	11′ 1½″	242.0		8,000	450 @	300 @		40,000
Bristol	Mark VI	Beaufighter	Fighter	1	2		14	Hercules	57′ 10″	41′ 4″	15′ 10″	503.0				1500 @		
Hawker	1B	Typhoon	Fighter	1	1	2200 @	24	Sabre II	41′ 7″	31′ 11″	15′ 3½″	278.0		11,300	400 @			
Hawker		Tempest	Fighter	1	1	2200 @	24	Sabre 11a	41′ 0″	38′ 8″	14′ 10″							
Vickers-Armstrongs	Mark III	Seafire	Fighter	1	1	1470 @	12	Merlin 55	36′ 8″	30′ 0″	8′ 0″	242.0		7,000				
Fairey		Firefly	Fighter	2	1	2000 @	12	Griffon										
Avro	Mark I	York	Transport		4		12	Merlin XX	102′ 0″	78′ 0″	20′ 0″			60,000	300 @	3000 @		
Short	Mark III	Sunderland	Reconnaissance	10	4	1000 @ 3,000	9	Pegasus XVIII	112′ 9½″	85′ 4″	32′ 1½″	1687.0						
Vickers-Armstrongs		Warwick	Air/Sea/Rescue	7	2	1850 @		Pratt & Whitney	96′ 9″	72′ 3″	18′ 6″	1020.0		43,000				
	Mark I	Sea Otter	Reconnaissance	3–4	1	870 @	9	Mercury 30	46′ 0″	39′ 4¾″	16′ 2″	610.0		10,000				
Fairey	Mark I	Swordfish	Reconnaissance	2	1	750 @ 4750	9	Pegasus 30	45′ 6″	35′ 8″	12′ 4″	549.0		6,750	144 @ 5,000			
RUSSIAN																		
	TB-7		Bomber	7–10	4	1200 @ 19,500	12	M-35A	131′ 2″	73′ 10″	20′ 0″	2050.0	40,500	63,000	276 @ 21,000	2050 @ 232	20,000 in 21. min.	26,000
	DB-3F		Bomber	3–4	2	1100 @ 19,700	14	M-88	70′ 2″	47′ 7″	14′ 1″	710.0	13,200	18,600	300 @ 21,000	265 @ 785	21,000 in 14 min.	30,700
	ER-2		Bomber	4–5	2	1030 @ 14,800	12	M-105	65′ 7″	50′ 10″	15′ 0″	825.0	15,500	24,500	260 @ 16,000	1600 @ 203	16,000 in 17 min.	32,500
	PE-2		Bomber	3	2	1150 @ 13,100	12	M-107	56′ 1″	41′ 5″	13′ 10″	465.0	12,000	16,000	315 @ 15,000	720 @ 265	14,000 in 7.5 min.	27,000
	SB-3		Bomber	3	2	1030 @ 14,800	12	M-105	66′ 11″	41′ 0″	14′ 0″	615.0	11,200	15,500	275 @ 16,000	710 @ 235	16,000 in 8 min.	28,000
	YAK-4		Bomber	2–3	2	1030 @ 14,800	12	M-105	45′ 11″	32′ 10″	14′ 0″	340.0	11,000	14,500	325 @ 16,000	@ 259	16,000 in 8.2 min.	27,700
	IL-2 & 3		Bomber	1–2	1	1600 @ 6,600	12	M-38B	47′ 11″	38′ 0″	13′ 0″	380.0	10,300	11,700	280 @ 8,000	350 @ 235	7,000 in 3.6 min.	23,500
	SU-2		Bomber	2	1	1100 @ 19,700	14	M-88B	47′ 2″	31′ 10″	13′ 0″	310.0	9,500		300 @ 21,000	690 @ 245	21,000 in 16.8 min.	30,200
	I-16		Fighter	1	1	950 @ 14,800	9	M-63	29′ 2″	20′ 4″	12′ 0″	125.0	4,700	5,200	300 @ 17,000	290 @ 245	16,000 in 5.6 min.	29,000
	Lagg-3		Fighter	1	1	1030 @ 14,800	12	M-105P	32′ 2″	28′ 11″	13′ 0″	188.0	5,900	7,050	348 @ 16,400	@ 295	10,000 in 4.8 min.	27,200
	MIG-3		Fighter	1	1	1200 @ 19,700	12	M-35A	34′ 6″	26′ 8″	14′ 0″	200.0	5,700	6,650	378 @ 22,000	345 @ 312	21,000 in 9.1 min.	33,000
	PE-3		Fighter	1	2	1030 @ 14,800	12	M-105	56′ 1″	41′ 5″	13′ 10″	465.0	11,300	15,000	315 @ 16,000	750 @ 266	16,000 in 8.2 min.	27,500
	YAK-1		Fighter	1	1	1030 @ 14,800	12	M-105	32′ 10″	27′ 11″	14′ 0″	165.0	5,000	5,800	330 @ 16,000	425 @ 263	16,000 in 5.8 min.	31,000
	YAK-9		Fighter	1	1	1260 @ T.O.	12	M-105R	36′ 0″	30′ 0″				6,300	368 @ 19,640	530 @	16,400 in 5.5 min.	35,000
	U-2		Reconnaissance	1–2	1	100 @ S.L.	5	M-11	(a)	26′ 4″	10′ 0″	394.0	2,000	2,260	93 @ S.L.	330 @ 75	5,000 in 10 min.	12,000
	R-10		Reconnaissance	2	1	950 @ 14,800	9	M-63	42′ 4″	28′ 11″	11′ 7″	312.0	6,600	8,400	272 @ 16,000	600 @ 225	16,000 in 10.5 min.	25,000
	GST	Flying Boat	Reconnaissance	5–7	2	850 @ 7,500	9	M-25	104′ 0″	65′ 0″	18′ 6″	1400.0	17,500	25,000	178 @ 9,000	2000 @ 152	9,000 in 16 min.	20,000
	KOR-1		Reconnaissance	2	1	750 @ 9,500	9	M-25	35′ 0″				5,500	7,000	190 @ 10,000	630 @ 155	10,000 in 7.1 min.	22,400
	MBR-2		Reconnaissance	4	1	1250 @ 13,000	12	M-34RN	53′ 11″	32′ 10″	7′ 6″	538.0	6,700	9,000	183 @ 14,000	500 @ 153	13,000 in 8.6 min.	21,500
	MDR-6	Flying Boat	Reconnaissance	5–7	2	750 @ 9,500	9	M-25	75′ 0″			700.0	12,000	15,000	220 @ 10,000	985 @ 180	10,000 in 6.2 min.	27,200
	TB-3		Transport	6–8	4	1250 @ 13,000	12	M-34RN	129′ 7″	80′ 0″	13′ 0″	2048.0	25,000	33,000	180 @ 14,000	425 @ 155	14,000 in 6.1 min.	26,600
	PS-84		Transport	3	2	950 @ 14,800	9	M-63	94′ 10″	63′ 0″	17′ 0″	987.0	22,000	25,200	223 @ 16,000	840 @ 203	16,000 in 16.9 min.	25,200
GERMAN																		
Focke-Wulf	200C		Bomber	5–7	4	940 @ 12,000	9	Bramo 323R	107′ 7″	78′ 2″	20′ 7″	1270.0	33,000	50,000	240 @ 13,000	1870 @ 212	16,000 in 25.5 in.	20,500
Dornier	DO217K2		Bomber	4	2	1495 @ 17,750	14	BMW801/A2	80′ 6″	56′ 6″	12′ 6″	725.0			325 @ 20,000	1180 @ 200		
Heinkel	He III		Bomber	5–6	2	1075 @ 13,250	12	Jumo 211F	74′ 0″	53′ 8″	14′ 0″	944.0	21,300	25,500	252 @ 14,000	540 @ 210	17,000 in 19.3 min.	26,000
Heinkel	He 115		Bomber	3	2	960 @ 2,000	9	BMW 132K	72′ 6″	56′ 8″	21′ 7″	942.0		20,000	206 @ 11,500			
Heinkel	He 177		Bomber	7	2	2800 @ 17,000	24	DB610	103′ 6″	67′ 4″	21′ 11″	1095.0	43,000	68,000	300 @ 20,000	1150 @ 210		21,000
Henschel	Hs 129		Bomber	1	2	800 @ 8,000	14	Gnome-Rhone	44′ 6″	33′ 3″		305.0	9,300	11,400	275 @ 9,000	350 @ 216*		
Junkers	Ju 86P		Bomber	2	2	1000 @ 26,000	6	Jumo 207A/1	103′ 0″	53′ 0″	16′ 0″	1100.0	19,000	22,900	+260 @ 30,000	1500 @ 240		35,000
Junkers	Ju 88S		Bomber	3	2	1530 @ 20,000	14	BMW 801G2	65′ 11″	47′ 0″	16′ 8″	590.0	20,300	26,400	339 @ 20,000	610 @ 238	18,000 in 16.5 min.	30,000
Junkers	Ju 118		Bomber	4	2	1700 @ 22,000	12	Jumo 213A	72′ 6″	49′ 0″	16′ 8″	600.0			325 @ 20,000	800 @ 254	18,000 in 13 min.	33,000
Messerschmitt	Me110G		Bomber	2	2	1340 @ 18,700	12	DB605B	53′ 11″	40′ 4″	11′ 6″	415.0	13,000	20,900	325 @ 19,000	620 @ 230*	18,000 in 11.8 min.	29,000
Messerschmitt	Me210C		Bomber	2	2	1330 @ 16,000	12	DB605B/o	53′ 7″	40′ 3″	14′ 0″	400.0	15,500	21,600	370 @ 21,000	1180 @ 315	19,000 in 11.8 min.	29,000
Messerschmitt	Me410		Bomber	2	2	1680 @ 18,000	12	DB603A2	53′ 7″	40′ 11″	14′ 0″	400.0	18,000	24,000	395 @ 22,000	1040 @ 330	19,000 in 11.5 min.	30,000
Focke-Wulf	FW190		Bomber	1	1	1530 @ 20,000	14	BMW801D	34′ 6″	29′ 5″	11′ 6″	197.0	7,500	9,800	370 @ 19,000	@ 310	18,000 in 8.5 min.	31,500
Junkers	Ju87D		Bomber	2	1	1260 @ 12,500	12	Jumo 211J	45′ 4″	36′ 6″	13′ 0″	335.0	8,900	12,600	255 @ 13,500	700 @ 200	15,000 in 19 min.	18,500
Messerschmitt	Me109G		Bomber	1	1	1340 @ 18,700	12	DB605B	32′ 8″	29′ 11″	10′ 6″	172.0	5,900	7,280	370 @ 22,000	420 @ 310	19,000 in 7 min.	35,500
Dornier	217J		Fighter	3	2	1530 @ 20,000	14	BMW801D	62′ 5″	58′ 0″	12′ 6″	610.0	22,000	27,500	328 @ 20,000	1180 @ 280	18,000 in 13.8 min.	29,000
Focke-Wulf	Fw190		Fighter	1	1	1530 @ 20,000	14	BMW801D	34′ 6″	29′ 5″	11′ 6″	197.0	7,500	8,600	385 @ 19,000	445 @ 330	18,000 in 6.5 min.	36,000

Junkers	Ju88-C5		Fighter	2–3	2	1530 @ 20,000	14	BMW801D	65′ 11″	47′ 0″	16′ 8″	590.0	21,000	25,000	347 @ 20,000	570 @ 317	18,500 in 10.3 min.	30,200
Junkers	Ju88-C6		Fighter	3	2	1305 @ 12,500	12	Jumo 211J	65′ 11″	47′ 0″	16′ 7″	590.0	20,000	24,000	295 @ 14,000	720 @ 270	16,500 in	24,200
Messerschmitt	Me109G		Fighter	1	1	1340 @ 18,700	12	DB605A1	32′ 8″	29′ 11″	10′ 6″	172.0	5,900	6,120	400 @ 22,000	450 @ 330	19,000 in 6 min.	38,500
Messerschmitt	Me110G		Fighter	2	2	1340 @ 18,700	12	DB605B	53′ 11″	40′ 4″	11′ 6″	415.0	16,510	18,000	368 @ 19,000	690 @ 305	18,000 in 7.3 min.	34,800
Messerschmitt	Me163		Fighter	1	1	Liquid Rocket Propelled.			31′ 0″	23′ 0″					+500 @		15,000 in 3 min.	
Messerschmitt	Me262		Fighter	1	2	Jet Propelled — Turbine Type			41′ 0″	35′ 5″		226.0			+550 @			
Arado	AR196		Reconnaissance	2	1	920 @		Bramo	49′ 6″	38′ 6″	16′ 5″	408.0	6,580†	8,200	193 @ 13,000	670 @ 158	980 ft. per min.	23,000
Arado	AR240V		Reconnaissance	2	2	1335 @ 18,700	12	DB605B	50′ 0″	38′ 0″	11′ 0″	1400.0			+370 @ 22,000			42,000
Blohm & Voss	BV138		Reconnaissance	5	3	600 @		Junkers	88′ 7″	65′ 3″	19′ 10″	1104.0	17,820†	26,180	171 @ S.L.	1490 @ 146	729 ft. per min.	16,000
Blohm & Voss	BV131B		Reconnaissance	3	1	1495 @ 17,750	14	BMV801	60′ 0″	45′ 0″		1580.0	7,400	8,500	280 @ 16,000			
Dornier	DO18L		Reconnaissance															
Dornier	DO24		Reconnaissance	6	3	760 @		BMW	88′ 7″	72′ 2″	17′ 10″	1162.0	17,000†	29,700	195 @ 5,900	2050 @ 161		17,400
Fieseler	FI156		Reconnaissance	2–3	1	240 @ S.L.	8	Argus	46′ 8″	31′ 10″	8′ 6″	280.0	2,250†	2,900	110 @	230 @ 82	6,500 in 9 min.	15,000
Focke-Wulf	FW189		Army Cooperat.	3	2	450 @ 9,500	12	Argus	60′ 5″	39′ 5″		409.0	6,300	7,500	210 @ 9,000	620 @ 190	10,000 in 6 min.	27,500
Henschel	HS126		Army Cooperat.	2	1	940 @ 12,000	9	Bramo 323	47′ 7″	35′ 8″	12′ 4″	341.0	6,300	7,250	230 @ 15,000	530 @ 192	13,000 in 10.2 min.	27,000
Arado	AR232		Transport															
Blohm & Voss	BV222		Transport		6	1000 @		BMW	150′ 0″	112′ 0″								
Focke-Wulf	FW58		Transport															
Gothaer	GO244		Transport	4	2	700 @		Gnome-Rhone	79′ 0″	52′ 6″	11′ 4″	762.0		17,500	169 @ 10,000			
Heinkel	He111Z		Transport	2	2	660 @		BMW	74′ 3″	56′ 2″	12′ 9″	947.0	12,120†	17,350	213 @ S.L.	930 @ 186	1090 ft. per min.	
Junkers	Ju52		Transport	3	3	845 @		BMW	95′ 11″	62′ 0″	14′ 10″	1190.0	16,320†	27,550	207 @ 8,500	806 @ 185	1020 ft. per min.	22,500
Junkers	Ju90		Transport	4	4	820 @		BMW	114′ 10″	86′ 3″	21′ 3″	1980.0	35,200†	50,600	216 @ 3,610	1305 @ 185	890 ft. per min.	18,040
Junkers	Ju252		Transport															
Junkers	Ju290		Transport															
Messerschmitt	Me323		Transport	5	6	965 @		Gnome-Rhone	181′ 0″	93′ 6″	24′ 0″	2700.0			170 @ S.L.	700 @ 100		

ITALIAN

Savoia-Marchetti	SM84		Bomber	4–5	3	1000 @ 13,200	14	Piaggio Px1	69′ 4″	60′ 0″		648.0	21,000	27,700	290 @ 15,000	950 @ 250	15,000 in 17 min.	24,000
Fiat	RS14		Bomber, Tpdo.	3	2	840 @ 12,500	14	Fiat A74RC38	64′ 3″	45′ 6″	17′ 9″	555.0	13,900	16,000	237 @ 13,000	1170 @ 204	13,000 in 10 min.	27,000
Reggiane	RE2000		Fighter	1	1	1000 @ 13,000	14	Piaggio Px1	36′ 1″	25′ 9″	12′ 0″	220.0	5,200	5,800	325 @ 15,000	400 @ 272	15,000 in 6.8 min.	32,000
Reggiane	RE2001		Fighter	1	1	1150 @ 16,000	12	DB601A/1	36′ 0″	27′ 4″	12′ 0″	220.0	5,800	7,000	350 @ 20,000	940 @ 300	18,000 in 8.3 min.	34,000
Saroia-Marchetti	SM81		Transport	4–5	3	700 @ 14,000	9	Alfa Romeo 125PC	79′ 0″	59′ 0″	15′ 0″	1000.0	15,800	22,200	210 @ 14,000	1035 @ 181	14,000 in 14.7 min.	
Saroia-Marchetti	SM82		Transport	4–5	3	860 @ 6,900	9	Alfa Romeo 125RC	97′ 6″	73′ 6″	18′ 0″	1290.0	34,000	39,700	205 @ 7,000	1160 @ 172	10,000 ir 16.5 min.	17,000

JAPANESE

		Liz	Bomber		4													
Mitsubishi	22	Nell	Bomber	4–7	2	1800 @ 9,800	14	Mitsubishi	82′ 0″	54′ 0″	13′ 6″	860.0	13,925	22,300	261 @ 21,500	2200 @ 203	10,000 in 6.7 min.	32,500
Mitsubishi	97, Mark 3	Sally	Bomber	7	2	1300 @ 13,200	14	Mitsubishi	72′ 0″	52′ 0″	12′ 0″	675.0	14,225	21,500	285 @ 15,000	.... @ 210	10,000 in 5.0 min.	29,800
	100	Helen	Bomber	5–7	2	1415 @ 11,000	14	Nakajima	66′ 7″	53′ 0″			16,130	26,491	299 @ 19,700	2040 @ 223	10,000 in 7.5 min.	29,200
Mitsubishi	11	Betty	Bomber	7–9	4	1500 @ T.O.	14	Mitsubishi	82′ 0″	64′ 7″	19′ 8″	838.0	16,700	26,975	276 @ 15,000	3900 @	10,000 in 7 min.	28,800
Mitsubishi	22	Betty	Bomber		2	1800 @ S.L.	18	Mitsubishi	82′ 0″	65′ 9″			17,000		330 @	2800 @	1200 ft. per min.	
Kawasaki	99, Marks, 1 & 2	Lily	Bomber	3–4	2	1020 @ 15,600	14	Kawasaki	56′ 11″	47′ 3″	14′ 9″	465.0	10,600	15,500	312 @ 17,000	1020 @ 232	10,000 in 4.6 min.	28,200
Nakajima	12	Kate	Bomber	2–3	1	1000 @ S.L.	14	Nakajima	51′ 0″	34′ 6″	13′ 6″		5,640	8,940	222 @ 8,500	1800 @ 166*	10,000 in 8.8 min.	23,800
Aichi	11	Val	Bomber	2	1	1000 @ T.D.	14	Mitsubishi	47′ 8″	32′ 11″	10′ 4″		5,800	8,379	254 @ 13,000	1200 @ 190*	10,000 in 5.6 min.	29,800
	12	Jill	Bomber		1			Mitsubishi	52′ 0″	37′ 0″					300 @	2000 @		
	2	Frances	Bomber		2		18								250 @	2600 @		
Nakajima	97	Nate	Fighter	1	1	915 @ 12,000	9	Nakajima	35′ 10″	24′ 4″	8′ 0″	200.0	3,854	4,643	284 @ 13,500	489 @ 196	10,000 in 3.4 min.	35,100
Mitsubishi	0, Marks 1 & 2	Zeke	Fighter	1	1	955 @ 14,500	14	Nakajima	39′ 5″	29′ 9″	9′ 2″	248.0	3,918	5,555	328 @ 16,000	790 @ 240	20,000 in 7.9 min.	38,600
Mitsubishi	32	Zeke	Fighter		1	1100 @ S.L.	14	Nakajima	36′ 5″	29′ 9″	9′ 2″		3,900		350 @	1500 @ 180	3500 ft. per min.	
Mitsubishi	52	Zeke	Fighter		1	1100 @ S.L.	14	Nakajima	36′ 2″	29′ 9″	9′ 2″		4,100		350 @	1500 @	2800 ft. per min.	
Mitsubishi	0, Mark 2	Hamp	Fighter	1	1	1120 @ 7,000	14	Nakajima	36′ 4″	29′ 9″	9′ 5″	238.0	4,113	5,650	348 @ 16,600	790 @ 256	10,000 in 8.3 min.	35,000
Nakajima	I, Marks 1 & 2	Oscar	Fighter	1	1	1135 @ 6,800	14	Nakajima	37′ 7″	29′ 0″	9′ 0″	240.0	4,370	5,500	342 @ 17,500	792 @ 252	20,000 ir 6.5 min.	38,400
Mitsubishi, seaplane	11	Rufe	Fighter	1	1	900 @ T.O.	14	Nakajima	39′ 5″	29′ 5″	14′ 0″	248.0	4,345	5,920	278 @ 16,000	1200 @ 204	10,000 in 4.6 min.	35,400
Kawasaki	2	Nick	Fighter	2	2	935 @ 18,200	14	Kawasaki	49′ 5″	34′ 6″		338.0	8,300	12,000	330 @	1100 @ 250	10,000 in 3 min.	35,000
Nakajima	2	Tojo	Fighter	1	1	1415 @ 11,000	14	Nakajima	31′ 0″	29′ 3″	9′ 6″	161.0	5,000	6,095	376 @ 17,000	650 @ 310	17,000 in 4.15 min.	39,600
Kawasacki	3	Tony	Fighter	1	1	1060 @ 15,000	12	Kawasacki	39′ 6″	29′ 6″	9′ 0″	210.0	5,200	6,982	356 @ 17,000	1035 @ 257	10,000 in 4 min.	35,700
	1	Frank	Fighter				18								+400 @	1700 @		
	2	Jack	Fighter		1	1875 @		Mitsubishi	35′ 5″	31′ 10″					400 @	1100 @		
Nakajima	2	Irving	Fighter		2	1100 @ S.L.		Nakajima	55′ 9″	40′ 0″	15′ 0″			10,000	330 @	2000 @	1700 ft. per min.	
Mitsubishi	98, Mark 3	Babs	Reconnaissance	2	1	1050 @ 6,200	14	Mitsubishi	40′ 0″	28′ 0″	9′ 4″	220.0	4,350	5,750	270 @ 15,000	450 @ 235		30,000
Mitsubishi	98	Ida	Reconnaissance	2–3	1	900 @ 9,000	14	Mitsubishi	47′ 9″	34′ 0″	11′ 10″	290.0	6,045	7,800	260 @ 13,000	500 @ 200*	13,000 in 10¾ min.	27,000
Mitsubishi	99	Sonia	Reconnaissance	2	1	900 @ S.L.	14	Mitsubishi	39′ 10″	30′ 2″	11′ 6″	220.0	5,100	6,500	270 @ 8,000	420 @ 220	10,000 in 5 min.	16,000
Mitsubishi	100, Marks 1 & 2	Dinah	Reconnaissance	2	2	1135 @ 6,800	14	Nakajima	48′ 3″	36′ 1″		375.0	9.165	12,225	347 @ 20,000	1165 @ 258	10,000 in 3.7 min.	34,700
Aichi	2	Judy	Reconnaissance	2	1	1160 @ 14,800	12	Aichi	37′ 9″	33′ 6″		254.0	5,818	8,060	326 @ 16,500	1455 @ 238	10,000 in 4.5 min.	31,700
Sasebo	2	Pete	Reconnaissance	2	1	940 @ 13,100	14	Mitsubishi	(b)	32′ 4″	15′ 0″	365.0	4,890	6,031	238 @ 14,000	627 @ 171	10,000 in 4.5 min.	33,100
Submarine borne	0	Glen	Reconnaissance	2	1	285 @ S.L.												
Watanabe	0, Mark 1	Jake	Reconnaissance	3	1	1050 @ 6,200	14	Mitsubishi	47′ 6″	35′ 4″	14′ 9″	385.0	6,468	9,223	216 @ 7,500	1205 @ 157*	10,000 in 6.8 min.	24,400
Kawanishi, flying boat	11	Mavis	Reconnaissance	8–10	4	1000 @ T.O.	14	Mitsubishi	131′ 0″	82′ 0″	20′ 7″	1776.0	27,607	43,156	237 @ 15,000	3900 @ 176*	10,000 in 8.6 min.	27,700
Kawanishi	99	Cherry	Reconnaissance	6	2	1010 @ S.L.	14	Nakajima	108′ 0″	86′ 0″	18′ 2″	750.0	14,200	18,000	175 @ 7,000	460 @ 150	7,000 in 6 min.	24,000
Kawanishi, flying boat	22	Emily	Reconnaissance	9	4	1300 @ 13,200	14	Mitsubishi	124′ 0″	92′ 6″	30′ 2″	1790.0	37,660	66,425	256 @ 14,200	3370 @ 194	10,000 in 9.6 min.	24,000
	2	Myrt	Reconnaissance	3	1		18	Homare							375 @	2600 @		
Nakajima	2	Dave	Reconnaissance		1	650 @ S.L.	9	Nakajima	(d)	28′ 4″	13′ 2″		3,800		180 @	800 @	900 ft. per min.	
Douglas (Nakajima)	DC-2	Tess	Transport	2–3	2	1050 @ 6,200	14	Mitsubishi	95′ 0″	64′ 5″	16′ 11″		12,800	18,500	212 @	1100 @ 160		22,000
Mitsubishi	MC-20	Topsy	Transport	4	2	1050 @ 6,200	14	Mitsubishi	74′ 0″	52′ 8″	16′ 0″	755.0	12,705	18,300	266 @ 10,500	1020 @ 197	10,000 in 6.6 min.	23,000
Lockheed, (originally)		Thelma	Transport	2–3	2	900 @ S.L.			65′ 6″	49′ 10″	11′ 10″	644.0	11,000	15,500	230 @	970 @ 185	10,000 in 11.5 min.	25,000

ABBREVIATIONS: (a)—Internal Combustion Turbines. (b)—Biplane, one wing 36′ 1″, other wing 35′ 10″. (c)—Biplane, one wing 37′ 6″, other wing 34′ 8″. (d)—Biplane, one wing 35′ 8″, other wing 34′ 6″.
*—With maximum bomb load. †—Weight empty. S.L.—Sea level. T.O.—Take-off. +—More than

AMERICAN AIRCRAFT ENGINES

ENGINE MAKE AND MODEL	A. T. C. Number	GENERAL DATA: Arrangement	Cooling Medium	Number of Cylinders—Bore and Stroke (In.)	Total Piston Displacement (Cu. In.)	Compression Ratio (to 1)	B.M.E.P. at Maximum Hp. (Lb. per Sq. In.)	Blower Ratio	Cylinder Material	No. of Valves per Cylinder: Intake	No. of Valves per Cylinder: Exhaust	Valve Arrangement	RATINGS: Maximum (Except Take-off): Horsepower	Maximum: R. P. M.	Maximum: At Sea Level or Altitude (Ft.)	Take-off: Horsepower	Take-off: R. P. M.	Cruising: Horsepower	Cruising: R. P. M.	Octane Rating of Fuel Required	Propeller Drive Ratio (to —1)	Weight (Lb.): Engine Dry—Without Hub or Starter	Weight: Per Maximum Hp.	Carburetor: Number Used and Make	Carburetor: Type	Ignition System—Make	Starting: Make	Starting: Method	Installation Dimensions (Overall—Ins.): Length	Height or O. D.	Width	Height above Engine Bed	Diameter Mounting Ring or Distance Between Bearers
Allison....E11	....	V60	Liq	12-5½x6	1710.0	6.65	178	‡8.10	(5)	2	2	OH	1000	2600	17500	1325	3000	750	2300	100	2.23	1620	1.62	1-Str	PI	Scin	JH	EM	216	40 1/16	29 9/32	25 13/16	18⅝
Allison....E21	....	V60	Liq	12-5½x6	1710.0	6.65	178	♦8.10	(5)	2	2	OH	1000	2600	21000	1325	3000	750	2300	100	2.23	1660	1.66	1-Str	PI	Scin	JH	EM	215 5/16	40 13/16	29 9/32	25 25/32	18⅝
Allison....F17R-F17L	....	V60	Liq	12-5½x6	1710.0	6.65	196	8.10	(5)	2	2	OH	1100	2600	††	1425	3000	825	2300	100	2.00	1350	1.22	1-Str	PI	Scin	Ecl	EM	85⅞	36¾	29 9/32	23 9/32	18⅝
Allison....F26	....	V60	Liq	12-5½x6	1710.0	6.65	178	9.60	(5)	2	2	OH	1000	2600	15700	1200	3000	750	2300	100	2.00	1352	1.35	1-Str	PI	Scin	Ecl	EM	85⅞	36¾	29 9/32	23 9/32	18⅝
Allison....F30R-F30L	....	V60	Liq	12-5½x6	1710.0	6.65	196	8.10	(5)	2	2	OH	1100	2600	†††	1475	3000	825	2300	100	2.00	1395	1.26	1-Str	PI	Scin	Ecl	EM	85 13/16	37 21/32	29 9/32	23 21/64	18⅝
Allison....F31	....	V60	Liq	12-5½x6	1710.0	6.65	178	9.60	(5)	2	2	OH	1000	2600	14400	1200	3000	750	2300	100	2.00	1385	1.38	1-Str	PI	Scin	Ecl	EM	85 13/16	36¾	29 9/32	23 21/64	18⅝
Allison....A16R-A16L	....	V60	Liq	24-5½x6	3420.0	6.65	187	‡	(5)	2	2	OH	2100	2600	††††	2600	3000	1407	2300	100	3.13	2665	1.26	1-Str	PI	Scin	JH	EM	95 13/16	37 21/32	60	30 7/16	24½
Continental....A65-8	205	Hor	Air	4-3⅞x3⅝	171.0	6.30	131	No	(5)	1	1	In	65	2300	SL	75	2600	58.5	2150	73	D	175	2.69	1-Str	FL	Scin	None		30 13/32	20 5/16	31½	....	....
Continental....C75-12	233	Hor	Air	4-4 1/16x3⅝	188.0	6.30	139	No	(5)	1	1	In	75	2275	SL	....	....	67.5	2125	73	D	186	2.48	1-Str	FL	Scin	DR	EM	31⅝	21¼	31½	....	....
Continental....C85-12	....	Hor	Air	4-4 1/16x3⅝	188.0	6.30	138	No	(5)	1	1	In	85	2600	SL	....	....	76.5	2400	73	D	186	2.18	1-Str	FL	Scin	DR	EM	31⅝	21¼	31½	....	....
Continental....C115-1	....	Hor	Air	6-4 1/16x3⅝	282.0	6.30	138	No	(5)	1	1	In	115	2350	SL	....	....	103.5	2200	73	D	262	2.27	1-MS	FL	Scin	DR	EM	41⅝	24¾	31½	....	....
Continental....C125-1	....	Hor	Air	6-4 1/16x3⅝	282.0	6.30	138	No	(5)	1	1	In	125	2550	SL	....	....	112.5	2350	73	D	262	2.09	1-MS	FL	Scin	DR	EM	41⅝	24¾	31½	....	....
Continental....C140-1	....	Hor	Air	6-4 1/16x3⅝	282.0	6.30	131	No	(5)	1	1	In	140	3000	SL	....	....	126.0	2700	73	1.55	298	2.12	1-MS	FL	Scin	DR	EM	46¾	24¾	31½	....	....
Continental....W670-6A	162	Rad	Air	7-5⅛x4⅝	667.8	5.40	126	No	(5)	1	1	In	220	2075	SL	....	....	198.0	1850	73	D	465	2.11	1-Str	FL	Scin	DR	EM	34 3/16	42¼	42¼	....	....
Franklin (1)....4AC-176-BA2	221	Hor	Air	4-4x3½	176.0	6.00	127	No	(1)	1	1	In	65	2300	SL	....	....	....	....	73	1.00	182	2.80	1-MS	FL	Eis	AL	PS	28⅝	20	30¼	8⅜	10⅝ (k)
Franklin....4AC-176-BA3	221	Hor	Air	4-4x3½	176.0	6.00	127	No	(1)	1	1	In	65	2300	SL	....	....	....	....	73	1.00	202	3.10	1-MS	FL	Eis	AL	EM	30¾	24 9/16	30¼	13	10⅝ (k)
Franklin....4AC-199-D3	226	Hor	Air	4-4¼x3½	199.0	6.30	136	No	(1)	1	1	In	85	2500	SL	....	....	....	....	73	1.00	208	2.44	1-MS	FL	Eis	AL	EM	30¾	24 9/16	30¼	13	10⅝ (k)
Franklin....4AC-199-E3	226	Hor	Air	4-4¼x3½	199.0	7.00	143	No	(1)	1	1	In	90	2500	SL	....	....	....	....	80	1.00	209	2.32	1-MS	FL	Eis	AL	EM	30¾	24 9/16	30¼	13	10⅝ (k)
Franklin....6AC-298-F3	225	Hor	Air	6-4¼x3½	298.0	7.00	135	No	(1)	1	1	In	130	2550	SL	....	....	....	....	80	1.00	280	2.15	1-MS	FL	Eis	AL	EM	40	24 9/16	30¼	13	10⅝ (k)
Franklin....6ACV-298	....	VO	Air	6-4¼x3½	298.0	7.00	131	No	(1)	1	1	In	160	3250	SL	....	....	....	....	80	1.00	298	1.86	2-MS	FL	Eis	DR	EM	36¼	26¾	30½	25½	10⅝ (n)
Franklin....6ACV-403	....	VO	Air	6-4⅝x4	403.0	7.70	147	No	(1)	1	1	In	245	3275	SL	....	....	....	....	80	1.00	435	1.77	2-MS	PI	Eis	DR	EM	43⅜	33¾	33¼	30 11/16	12⅛ (r)
Jacobs, R-755A1....(L-4MB)	121	Rad	Air	7-5¼x5	757.0	5.40	118	No	(5)	1	1	In	225	2000	SL	245	2200	160	1900	73	D	505	2.24	1-Str	FL	Scin	Ecl	EM	40 7/32	44	....	....	16½
Jacobs, R-755A3....(L-4M)	121	Rad	Air	7-5¼x5	757.0	5.40	118	No	(5)	1	1	In	225	2000	SL	245	2200	160	1900	73	D	507	2.24	1-Str	FL	Scin	Ecl	EM	40 7/32	44	....	....	16½
Jacobs....(L-4MA7)	121	Rad	Air	7-5¼x5	757.0	5.40	118	No	(5)	1	1	In	225	2000	SL	245	2200	160	1900	73	D	510	2.26	1-Str	FL	Scin	Ecl	EM	41⅞	44	....	....	16½
Jacobs, R-915A1....(L-6MB)	195	Rad	Air	7-5½x5½	914.0	6.00	124	No	(5)	1	1	In	300	2100	SL	330	2200	210	1900	80	D	555	1.85	1-Str	FL	Scin	Ecl	EM	40 1/16	45⅝	....	....	16½
Jacobs, R-915A3....(L-6M)	195	Rad	Air	7-5½x5½	914.0	6.00	124	No	(5)	1	1	In	300	2100	SL	330	2200	210	1900	80	D	557	1.85	1-Str	FL	Scin	Ecl	EM	40 1/16	45⅝	....	....	16½
Jacobs, R-915A4....(L-6MBA)	195	Rad	Air	7-5½x5½	914.0	6.00	124	No	(5)	1	1	In	300	2100	SL	330	2200	210	1900	80	D	558	1.86	1-Str	FL	Scin	Ecl	EM	41 11/16	45⅝	....	....	16½
Jacobs....(L-6MA)	195	Rad	Air	7-5½x5½	914.0	6.00	124	No	(5)	1	1	In	300	2100	SL	330	2200	210	1900	80	D	560	1.86	1-Str	FL	Scin	Ecl	EM	41 11/16	45⅝	....	....	16½
Ken-Royce (2)....5G	46	Rad	Air	5-4¼x3¾	266.0	6.10	119	No	(5)	1	1	In	90	2250	SL	90	2250	....	....	73	1.00	226	2.51	1-Hol	FL	Scin	EC	EM	23¾	33¼	....	....	....
Ken-Royce....7G	52	Rad	Air	7-4¼x3¾	372.0	6.10	115	No	(5)	1	1	In	120	2225	SL	120	2225	90	2025	73	1.00	285	2.37	1-Hol	FL	Scin	EC	EM	24 9/16	33¼	....	....	....
Kinner....K-5	3	Rad	Air	5-4¼x5¼	372.0	5.10	118	No	(5)	1	1	In	100	1810	SL	100	1810	75	1610	73	1.00	304	3.04	1-SH	FL	Scin	Ecl	Opt	15⅞	45 13/32	....	....	14
Kinner....B-5	51	Rad	Air	5-4⅝x5¼	441.0	5.25	116	No	(5)	1	1	In	125	1925	SL	125	1925	90	1725	73	1.00	312	2.49	1-SH	FL	Scin	Ecl	Opt	15⅞	45 13/32	....	....	14
Kinner....B-54	51	Rad	Air	5-4⅝x5¼	441.0	5.25	116	No	(5)	1	1	In	125	1925	SL	125	1925	90	1725	73	1.00	312	2.49	1-SH	FL	Scin	Ecl	Opt	16¼	45 13/32	....	....	14
Kinner....R-5, Series 2	153	Rad	Air	5-5x5½	540.0	5.50	127	No	(5)	1	1	In	160	1850	SL	160	1850	115	1650	73	1.00	335	2.09	1-SH	FL	Scin	Ecl	Opt	15⅞	45 13/32	....	....	14
Kinner....R-55	153	Rad	Air	5-5x5½	540.0	5.50	127	No	(5)	1	1	In	160	1850	SL	160	1850	115	1650	73	1.00	346	2.16	1-SH	FL	Scin	Ecl	Opt	16¼	45 13/32	....	....	14
Kinner....R-56	153	Rad	Air	5-5x5½	540.0	5.50	127	No	(5)	1	1	In	160	1850	SL	160	1850	115	1650	73	1.00	362	2.26	1-Hol	FL	Scin	Ecl	Opt	16¼	45 13/32	....	....	14
Lycoming (3)....O-145-B3	210	Hor	Air	4-3⅝x3½	144.5	6.50	140	No	(4)	1	1	In	65	2550	SL	....	....	49	2310	73	1.00	166	2.55	1-MS	FL	Scin	Ecl	EM	24.62	22.59	29.56	....	(s)
Lycoming....O-235-C	....	Hor	Air	4-4⅜x3⅞	234.0	6.25	135	No	(5)	1	1	In	104	2600	SL	....	....	78	2360	73	1.00	200	1.92	1-MS	FL	Scin	DR	EM	30.00	25.63	32.08	....	(t)
Lycoming....O-290-A	229	Hor	Air	4-4⅞x3⅞	289.0	6.50	132	No	(5)	1	1	In	125	2600	SL	....	....	94	2360	73	1.00	240	1.92	1-MS	FL	Scin	DR	EM	31.54	26.64	32.32	....	(t)
Lycoming....GO-290-A	....	Hor	Air	4-4⅞x3⅞	289.0	6.50	132	No	(5)	1	1	In	145	3000	SL	....	....	109	2720	73	.641	289	1.99	1-MS	FL	Scin	DR	EM	41.85	28.52	32.32	....	(t)
Lycoming....O-435-A	228	Hor	Air	6-4⅞x3⅞	434.0	6.50	136	No	(5)	1	1	In	190	2550	SL	....	....	143	2310	73	1.00	347	1.82	1-MS	FL	Scin	DR	EM	46.32	28.04	32.32	....	(u)
Lycoming....O-435-B	228	Hor	Air	6-4⅞x3⅞	434.0	7.50	143	No	(5)	1	1	In	235	3000	SL	....	....	177	2720	100	1.00	363	1.54	1-MS	FL	Scin	Ecl	EM	45.48	29.61	32.32	....	(u)
Lycoming....GO-435	228	Hor	Air	6-4⅞x3⅞	434.0	6.50	128	No	(5)	1	1	In	210	3000	SL	....	....	158	2720	73	.641	399	1.90	1-MS	FL	Scin	Ecl	EM	27.70	29.61	32.32	....	(u)
Lycoming....R-680-E3A	202	Rad	Air	9-4⅝x4½	680.4	7.00	151	1.00	(5)	1	1	In	285	2200	SL	300	2300	225	1995	87	1.00	515	1.80	1-Str	FL	Scin	Ecl	EM	37.50	43.50	43.50	....	19.25
Pratt & Whitney....Wasp Junior-T1B3	123	Rad	Air	9-5 3/16x5 3/16	985.0	6.00	157	10.00	(5)	1	1	In	450	2300	SL	450	2300	300	2000	91/96	1.00	674	1.49	1-Str	FL	Bos	Opt	EM	43.06	46.13	....	....	23⅜
....SB3	123	Rad	Air	9-5 3/16x5 3/16	985.0	6.00	146	10.00	(5)	1	1	In	400	2200	5000	450	2300	300	2000	91/96	1.00	682	1.70	1-Str	FL	Bos	Opt	EM	43.06	46.13	....	....	23⅜
Pratt & Whitney....Wasp-S3H1	143	Rad	Air	9-5¾x5¾	1344.0	6.00	147	10.00	(5)	1	1	In	550	2200	5000	600	2250	400	2000	91/96	1.00	865	1.57	1-Str	FL	Scin	Opt	EM	43.00	51.81	....	....	23⅜
....S3H1-G	142	Rad	Air	9-5¾x5¾	1344.0	6.00	147	10.00	(5)	1	1	In	550	2200	5000	600	2250	400	2000	91/96	.667	938	1.70	1-Str	FL	Scin	Opt	EM	47.81	51.81	....	....	23⅜
Pratt & Whitney....Twin Wasp-S1C3-G	186	Rad	Air	14-5½x5½	1830.0	6.70	178	7.15	(5)	1	1	In	1050	2550	7500	1200	2700	700	2250	91/96	.562	1467	1.39	1-Str	PI	Bos	Opt	EM	61.16	48.19	....	....	27
....S3C4-G	186	Rad	Air	14-5½x5½	1830.0	6.70	187	7.15	(5)	1	1	In	L1100	2550	6100	1200	2700	700	2250	100/130	.562	1492	1.35	1-Str	PI	Bos	Opt	EM	63.44	48.19	....	....	27
....	....	(2-Speed	Blower Engine)		....	....	170	8.47	....	....	....	....	H1000	2550	12500	....	....	675	2250	....	....	....	....	....	....	....	....	....	....	....	....	....	....

	2SD-G	230	Rad	Air	14-5¾x5½	2000.0	6.50	171	7.15	(5)	1	1	In	L1100	2550	7000	1350	2700	735	2230	100/130	.500	1570	1.42	1-Str	PI	Scin	Opt	EM	59.63	49.50			27
			(2-S	peed	Blower Engi	ne)		155	8.47					H1000	2550	14000			675	2230														
	2SD12-G		Rad	Air	14-5¾x5½	2000.0	6.50	186	7.15	(5)	1	1	In	L1200	2550	5000	1450	2800			100/130	.500	1590	1.32	1-Str	PI	Scin	Opt	EM	61.02	49.50			27
			(2-S	peed	Blower Engi	ne)		163	9.52					H1050	2550	15000																		
Pratt & Whitney	Double Wasp-2SB-G	231	Rad	Air	18-5¾x6	2804.0	6.65	188	7.60	(5)	1	1	In	L1600	2400	5700	2000	2700	1070	2100	100/130	.500	2290	1.43	1-Str	PI	Scin	Opt	EM	75.72	52.50			30
			(2-S	peed	Blower Engi	ne)		171	9.89					H1450	2400	13000			975	2100														
	SSB2-G		Rad	Air	18-5¾x6	2804.0	6.65	186	7.80	(5)	1	1	In	M1675	2550	5500	2000	2700	1120	2230	100/130	.500	2480	1.48	1-Str	PI	Scin	Opt	EM	88.47	52.50			30
			(2-S	peed-	2 Stage-Blo	wer En	gine)	181	16.46					L1625	2550	17000			1100	2230		.562	2460	1.51										
								172	47.93					H1550	2550	21500			1040	2230														
	TSB-1G		Rad	Air	18-5¾x6	2804.0	6.65	181	7.60	(5)	1	1	In	1625	2550	6500	2000	2700	1090	2230	100/130	.500	2260	1.39	1-Str	PI	Scin	Opt	EM	75.72	52.50			30
Ranger	6-440C-2	216	IV-L	Air	6-4⅛x5½	441.0	6.00	128	No	(5)	1	1	OH	175	2450	SL	175	2450	131	2230	65	D	376	2.14	1-Str	FL	Scin		EM	53.16	33.50	21.60		26.87
Ranger	6-440C-3	216	IV-L	Air	6-4⅛x5½	441.0	6.20	132	No	(5)	1	1	OH	180	2450	SL	180	2450	135	2230	73	D	376	2.08	1-Str	FL	Scin		EM	53.16	33.50	21.60		26.87
Ranger	6-440C-4	216	IV-L	Air	6-4⅛x5½	441.0	6.80	139	No	(5)	1	1	OH	190	2450	SL	190	2450	142	2230	80	D	376	1.97	1-Str	FL	Scin		EM	53.16	33.50	21.60		26.87
Ranger	6-440C-5	216	IV-L	Air	6-4⅛x5½	441.0	7.50	146	No	(5)	1	1	OH	200	2450	SL	200	2450	150	2230	87	D	376	1.88	1-SM	FL	Scin		EM	53.16	33.50	21.87		26.87
Ranger	L-440D-1	Pen.	IV-L	Air	6-4⅛x5½	441.0	7.85	152	No	(5)	1	1	OH	220	2600	SL	220	2600	165	2360	91	D	396	1.80	1-MS	FL	Scin		EM	53.16	33.50	21.87		26.87
Ranger	SGV-770C-1B	232	IV-V	Air	12-4x5⅛	773.0	6.50	154	9.50	(5)	1	1	OH	450	3000	12000	520	3150	338	2725	91	.667	760	1.68	1-Str	PI	Scin		EM	66.95	34.12	32.44		22.03
Ranger	SGV-770D-5		IV-V	Air	12-4x5⅛	773.0	6.50	186	8.85	(5)	1	1	OH	600	3300	8000	700	3500	450	2985	130	2.37	870	1.45	1-Str	PI	Scin		EM	75.74	31.11	33.28		22.03
Rolls-Royce (4)	1650-7		Vee	Liq	12-5.4x6	1649.0	6.00	210	5.80	(7)	1	1	In	1180	2700	11300	1490	3000			100		1690	1.43	1-Str	PI	DR	Ecl	EM	87.12	40.86	30.70		
			(2-S	tage-	2 Speed-Blo	wer Eng	ine)		7.35																									
Warner	Scarab 50	2	Rad	Air	7-4⅛x4⅛	422.0		114	No	(5)	1	1	In	125	2050	SL	131	2050	(e)		73	D	285	2.28	1-Hol		Scin	Opt	Opt	29	36 9/16			
Warner	50A	104	Rad	Air	7-4⅝x4¼	499.0		112	No	(5)	1	1	In	145	2050	SL	152	2160	(e)		73	D	303	2.08	1-Hol		Scin	Opt	Opt	29	36 9/16			
Warner	Super Scarab 165	214	Rad	Air	7-4⅝x4¼	499.0		125	No	(5)	1	1	In	165	2100	SL	175	2250	(e)		73	D	341	2.06	1-Hol		Scin	Opt	Opt	30½	37¼			
Warner	Super Scarab 185	Pen.	Rad	Air	7-4⅞x4¼	555.0		126	No	(5)	1	1	In	185	2100	SL	200	2475	(e)		73	D	344	1.85	1-Hol		Scin	Opt	Opt	30½	37¼			
Wright	Whirlwind R-760-ET	126	Rad	Air	7-5x5½	756.0	6.10	123	No	(5)	1	1	In	235	2000	SL			195	1850	73	1.00	540	2.29	1-Str	FL	Scin	Opt	EM	42 7/16	45			20
Wright	Whirlwind R-760-E1	94	Rad	Air	7-5x5½	756.0	6.10	142	7.05	(5)	1	1	In	285	2100	SL	300	2250	225	2000	73	1.00	570	2.00	1-Str	FL	Scin	Opt	EM	42.44	45			20
Wright	Whirlwind R-760-E2	155	Rad	Air	7-5x5½	756.0	6.30	152	9.17	(5)	1	1	In	320	2200	SL	350	2400	225	2000	91	1.00	570	1.78	1-Str	FL	Scin	Opt	EM	42.44	45			20
Wright	Whirlwind R-975-E1	87	Rad	Air	9-5x5½	973.0	6.10	142	7.80	(5)	1	1	In	365	2100	SL			290	1950	73	1.00	660	1.80	1-Str	FL	Scin	Opt	EM	42.44	45			20
Wright	Whirlwind R-975-E3	125	Rad	Air	9-5x5½	973.0	6.30	155	10.15	(5)	1	1	In	420	2200	1400	450	2250	325	2000	91	1.00	675	1.60	1-Str	FL	Scin	Opt	EM	41 11/16	45			20
Wright	Cyclone R-1820-F52	148	Rad	Air	9-6⅛x6⅞	1823.0	6.40	160	7.00	(5)	1	1	In	775	2100	5900	890	2200	550	1900	91	1.00	1000	1.29	1-SH	FL	Scin	Opt	EM	43.38	54.12			24
Wright	Cyclone GR-1820-F52	148	Rad	Air	9-6⅛x6⅞	1823.0	6.40	157	7.00	(5)	1	1	In	760	2100	5800	875	2200	550	1900	91	.6875	1095	1.44	1-SH	FL	Scin	Opt	EM	47.81	54.12			24
Wright	Cyclone R-1820-F53	149	Rad	Air	9-6⅛x6⅞	1823.0	6.40	154	8.31	(5)	1	1	In	745	2100	9800	785	2200	550	1900	91	1.00	1000	1.34	1-SH	FL	Scin	Opt	EM	43.38	54.12			24
Wright	Cyclone GR-1820-F53	149	Rad	Air	9-6⅛x6⅞	1823.0	6.40	151	8.31	(5)	1	1	In	730	2100	9600	770	2200	550	1900	91	.6875	1095	1.50	1-SH	FL	Scin	Opt	EM	47.81	54.12			24
Wright	Cyclone R-1820-F55	198	Rad	Air	9-6⅛x6⅞	1823.0	6.40	157	7.14	(5)	1	1	In	L760	2100	5800	875	2200	550	1900	91	1.00	1012	1.33	1-SH	FL	Scin	Opt	EM	43.38	54.12			24
			(2-S	peed	Blower Engi	ne)		139	10.00					H675	2100	15300																		
Wright	Cyclone GR-1820-F55	198	Rad	Air	9-6⅛x6⅞	1823.0	6.40	157	7.14	(5)	1	1	In	L760	2100	5800	875	2200	550	1900	91	.6875	1107	1.45	1-SH	FL	Scin	Opt	EM	47.81	54.12			24
			(2-S	peed	Blower Engi	ne)		139	10.00					H675	2100	15300																		
Wright	Cyclone R-1820-F56	159	Rad	Air	9-6⅛x6⅞	1823.0	6.40	156	8.83	(5)	1	1	In	755	2100	11300	785	2200	550	1900	91	1.00	1000	1.32	1-SH	FL	Scin	Opt	EM	43.38	54.12			24
Wright	Cyclone GR-1820-F56	159	Rad	Air	9-6⅛x6⅞	1823.0	6.40	153	8.83	(5)	1	1	In	740	2100	11300	770	2200	550	1900	91	.6875	1095	1.47	SCH	FL	Scin	Opt	EM	47.81	54.12			24
Wright	Cyclone R-1820-F62	148	Rad	Air	9-6⅛x6⅞	1823.0	6.40	157	7.00	(5)	1	1	In	760	2100	5800	900	2350	550	1900	91	1.00	1000	1.31	1-SH	FL	Scin	Opt	EM	43.38	54.12			24
Wright	Cyclone GR-1820-F62	148	Rad	Air	9-6⅛x6⅞	1823.0	6.40	157	7.00	(5)	1	1	In	L760	2100	5800	900	2350	550	1900	91	.6875	1095	1.44	SCH	FL	Scin	Opt	EM	47.81	54.12			24
			(2-S	peed	Blower Engi	ne)		139	10.00					H675	2100	15300																		
Wright	Cyclone R-1820-F65	198	Rad	Air	9-6⅛x6⅞	1823.0	6.40	157	7.14	(5)	1	1	In	L760	2100	5800	900	2350	550	1900	91	1.00	1012	1.33	SCH	FL	Scin	Opt	EM	43.38	54.12			24
			(2-S	peed	Blower Engi	ne)		139	10.00					H675	2100	15300																		
Wright	Cyclone GR-1820-F65	198	Rad	Air	9-6⅛x6⅞	1823.0	6.40	157	7.14	(5)	1	1	In	L760	2100	5800	900	2350	550	1900	91	.6875	1107	1.45	I-SH	FL	Scin	Opt	EM	47.81	51.12			24
			(2-S	peed	Blower Engi	ne,		139	10.00					H675	2100	15300																		
Wright	Cyclone R-1820-G2	157	Rad	Air	9-6⅛x6⅞	1823.0	6.45	176	7.00	(5)	1	1	In	850	2100	5800	1000	2200	600	1900	91	1.00	1103	1.29	I-SH	FL	Scin	Opt	EM	43.25	51.25			24
Wright	Cyclone GR-1820-G2	157	Rad	Air	9-6⅛x6⅞	1823.0	6.45	176	7.00	(5)	1	1	In	850	2100	5800	1000	2200	600	1900	91	.6875	1198	1.40	1-SH	FL	Scin	Opt	EM	47.75	51.25			24
Wright	Cyclone R-1820-G3	171	Rad	Air	9-6⅛x6⅞	1823.0	6.45	174	8.31	(5)	1	1	In	840	2100	8700	875	2200	600	1900	91	1.00	1103	1.31	1-SH	FL	Scin	Opt	EM	43.25	51.25			24
Wright	Cyclone GR-1820-G3	171	Rad	Air	9-6⅛x6⅞	1823.0	6.45	174	8.31	(5)	1	1	In	840	2100	8700	875	2200	600	1900	91	1.00	1103	1.31	1-SH	FL	Scin	Opt	EM	47.75	54.25			24
Wright	Cyclone R-1820-G3B	171	Rad	Air	9-6⅛x6⅞	1823.0	6.20	170	8.31	(5)	1	1	In	820	2100	8800	900	2350	600	1900	91	1.00	1103	1.31	1-SH	FL	Scin	Opt	EM	43.25	54.25			24
Wright	Cyclone GR-1820-G3B	171	Rad	Air	9-6⅛x6⅞	1823.0	6.20	170	8.31	(5)	1	1	In	820	2100	8800	900	2350	600	1900	91	.6875	1193	1.46	1-SH	FL	Scin	Opt	EM	47.75	51.25			24
Wright	Cyclone R-1820-G5	154	Rad	Air	9-6⅛x6⅞	1823.0	6.45	176	7.14	(5)	1	1	In	L850	2100	6000	1000	2200	600	1900	91	1.00	1115	1.31	1-SH	FL	Scin	Opt	EM	43.25	51.25			24
			(2-S	peed	Blower Engi	ne)		155	10.00					H750	2100	15200																		
Wright	Cyclone GR-1820-G5	154	Rad	Air	9-6⅛x6⅞	1823.0	6.45	176	7.14	(5)	1	1	In	L850	2100	6000	1000	2200	600	1900	91	.6875	1210	1.42	1-SH	FL	Scin	Opt	EM	47.75	54.25			24
			(2-S	peed	Blower Engi	ne)		155	10.00					H750	2100	15200																		24
Wright	Cyclone R-1820-G5E	154	Rad	Air	9-6⅛x6⅞	1823.0	6.45	176	7.14	(5)	1	1	In	L850	2100	6000	1000	2200	600	1900	91	1.00	1139	1.34	1-SH	FL	Scin	Opt	EM	43.25	51.25			24
			(2-S	peed	Blower Engi	ne)		155	10.00					H750	2100	15200																		
Wright	Cyclone GR-1820-G5E	154	Rad	Air	9-6⅛x6⅞	1823.0	6.45	176	7.14	(5)	1	1	In	L850	2100	6000	1000	2200	600	1900	91	.6875	1234	1.45	1-SH	FL	Scin	Opt	EM	47.75	54.25			24
			(2-S	peed	Blower Engi	ne)		155	10.00					H750	2100	15200																		
Wright	Cyclone GR-1820-G102A	169	Rad	Air	9-6⅛x6⅞	1823.0	6.30	170	7.00	(5)	1	1	In	900	2300	6700	1100	2350	625	1900	91	.6875†	1275	1.41	1-Hol	NF	Scin	Opt	EM	48.12	55.10			24
Wright	Cyclone GR-1820-G103A	180	Rad	Air	9-6⅛x6⅞	1823.0	6.30	162	8.31	(5)	1	1	In	860	2300	11100	1000	2350	625	1900	91	.6375†	1275	1.48	1-Hol	NF	Scin	Opt	EM	48.12	55.10			24
Wright	Cyclone 718C9GB1	192	Rad	Air	9-6⅛x6⅞	1823.0	6.30	170	7.134	(5)	1	1	In	900	2300	6700	1100	2350	625	1900	91	.6375†	1287	1.13	1-Hol	NF	Scin	Opt	EM	48.12	55.10			24
			(2-S	peed	Blower Engi	ne)		146	10.04					775	2300	17300																		
Wright	Cyclone 702C9GC	219	Rad	Air	9-6⅛x6⅞	1823.0	6.70	189	7.00	(5)	1	1	In	1000	2300	6900	1200	2500	700	2000	91	.5625†	1310	1.31	1-SH	PI	Scin	Opt	EM	50.04	55.12			24.5
Wright	Cyclone GR-1820-G203A		Rad	Air	9-6⅛x6⅞	1823.0	6.70	179	8.30	(5)	1	1	In	950	2300	9100	1100	2500	650	2000	91	.5625†	1310	1.37	1-SH	PI	Scin	Opt	EM	50.04	55.12			24.5
Wright	Cyclone 704C9GC	219	Rad	Air	9-6⅛x6⅞	1823.0	6.70	189	7.14	(5)	1	1	In	L1000	2300	6900	1200	2500	700	2000	91/100	.5325†	1320	1.32	1-SH	PI	Scin	Opt	EM	50.04	55.12			24.5
			(2-S	peed	Blower Engi	ne)		170	10.00					H900	2300	15200																		
Wright	Cyclore 728C9GC	219	Rad	Air	9-6⅛x6⅞	1823.0	6.30	189	7.00	(5)	1	1	In	1000	2300	6000	1200	2500	700	2000	91	.5625†	1310	1.31	1-SH	PI	Scin	Opt	EM	50.04	55.12			24.5
Wright	Cyclone 730C9GD1	219	Rad	Air	9-6⅛x6⅞	1823.0	6.20	189	7.00	(5)	1	1	In	1000	2300	6900	1200	2500	700	2000	91	.5625†	1310	1.31	1-SH	PI	Scin	Opt	EM	50.04	55.12			24.5
Wright	Cyclone C9HC		Rad	Air	9-6⅛x6⅞	1823.0	6.55	208	7.00	(5)	1	1	In	1200	2500	5000	1350	2700	780	2200	100/130	.5625†	1315	1.09	1-Str	PI	ES	Opt	EM	47.29	55.12			24.5
Wright	Cyclone C9HC		Rad	Air	9-6⅛x6⅞	1823.0	6.55	208	7.134	(5)	1	1	In	1200	2500	5500	1350	2700	780	2200	100/130	.5625†	1333	1.11	1-Str	PI	ES	Opt	EM	47.29	55.12			24.5
			(2-S	peed	Blower Engi	ne)		156	10.04					900	2500	18500																		
Wright	Cyclore 579C14AC1	176	Rad	Air	14-6⅛x6 5/16	2603.0	6.85	179	7.00	(5)	1	1	In	1350	2300	6200	1600	2400	900	1900	100	.5625	1935	1.43	1-Hol	NF	Scin	Opt	EM	62.06	55.00	55.00		27
Wright	Cyclone GR-2600-A2B	176	Rad	Air	14-6⅛x6 5/16	2603.0	6.30	179	7.00	(5)	1	1	In	1350	2300	5800	1600	2400	900	1900	91	.5625	1935	1.43	1-Hol	NF	Scin	Opt	EM	62.06	55.00	55.00		27
Wright	Cyclone GR-2600-A5A		Rad	Air	14-6⅛x6 5/16	2603.0	6.85	179	7.14	(5)	1	1	In	L1350	2300	5000	1600	2400	900	1900	100	.5325	1950	1.44	1-Hol	NF	Scin	Opt	EM	62.06	55.00	55.00		27
			(2-S	peed	Blower Eng	ine)		169	10.00					H1275	2300	12000																		

(continued on next page)

American Aircraft Engines—*Concluded*

ENGINE MAKE AND MODEL	A. T. C Number	GENERAL DATA: Arrangement	Cooling Medium	Number of Cylinders	Bore and Stroke (In.)	Total Piston Displacement (Cu. In.)	Compression Ratio (to 1)	B.M.E.P. at Maximum Hp. (Lb. per Sq. In.)	Blower Ratio	Cylinder Material	No. of Valves per Cylinder: Intake	Exhaust	Valve Arrangement	RATINGS: Maximum (Except Take-off): Horsepower	R. P. M.	At Sea Level or Altitude (Ft.)	Take-off: Horsepower	R. P. M.	Cruising: Horsepower	R. P. M.	Octane Rating of Fuel Required	Propeller Drive Ratio (to —1)	Weight (Lb.): Engine Dry—Without Hub or Starter	Per Maximum Hp.	Carburetor: Number Used and Make	Type	Ignition System—Make	Starting: Make	Method	Installation Dimensions (Overall—Ins.): Length	Height or O. D.	Width	Height above Engine Bed	Diameter Mounting Ring or Distance Between Bearers
Wright .... Cyclone GR-2600-A5B	....	Rad	Air	14	$6\frac{1}{8}x6\frac{5}{16}$	2603.0	6.30	179	7.14	(5)	1	1	In	L1350	2300	5000	1600	2400	900	1900	91	.5625	1950	1.44	1-Hol	NF	Scin	Opt	EM	62.06	55.00	55.00	....	27
....	....	(2-S	peed	Blower	Engi	ne)	....	169	10.00	....	....	....	....	H1275	2300	11500	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Wright .... Cyclone 585C14BA	176	Rad	Air	14	$6\frac{1}{8}x6\frac{5}{16}$	2603.0	6.90	190	7.30	(5)	1	1	In	1500	2400	6700	1700	2500	1000	2000	100	.5625‡	1965	1.31	1-Hol	NF	Scin	Opt	EM	62.06	54.25	....	....	28
Wright .... Cyclone 586C14BA	176	Rad	Air	14	$6\frac{1}{8}x6\frac{5}{16}$	2603.0	6.85	190	7.06	(5)	1	1	In	L1500	2400	6700	1700	2500	1000	2000	100	.5625‡	1980	1.32	1-Hol	NF	Scin	Opt	EM	62.06	54.25	....	....	28
....	....	(2-S	peed	Blower	Engi	ne)	....	179	10.02	....	....	....	....	H1350	2400	15000	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Wright .... Cyclone C14BB	....	Rad	Air	14	$6\frac{1}{8}x6\frac{5}{16}$	2603.0	6.90	203	7.06	(5)	1	1	In	L1600	2400	5000	1900	2800	1050	2100	100/130	.5625‡	2045	1.27	1-Str	PI	Bos	Opt	EM	66.08	54.08	....	–	28
....	....	(2-S	peed	Blower	Engi	ne)	....	179	10.04	....	....	....	....	H1350	2400	14800	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Wright .... Cyclone C18BA	....	Rad	Air	18	$6\frac{1}{8}x6\frac{5}{16}$	3347.0	6.85	197	6.06	(5)	1	1	In	L2000	2400	3000	2200	2800	1300	2100	100/130	.350	2646	1.32	1-Cec	PI	Scin	Opt	EM	76.26	53.75	....	....	38
Wright .... Cyclone C18BA	....	Rad	Air	18	$6\frac{1}{8}x6\frac{5}{16}$	3347.0	6.85	197	6.61	(5)	1	1	In	L2000	2400	4500	2200	2800	1300	2100	100/130	.4375	2670	1.33	1-Cec	PI	Scin	Opt	EM	76.26	53.75	....	....	38
....	....	(2-S	peed	Blower	Engi	re)	....	177	8.81	....	....	....	....	H1800	2400	14000	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

ABBREVIATIONS FOR AIRCRAFT ENGINES

General

‡—Auxiliary stage blower ratio 6.85
♦—Auxiliary stage blower ratio 7.23
‡—6.90 for A16R; 6.82 for A16L
(k)—By 12⅛ inches
Liq—Liquid cooled
(n)—By 18⅛ inches
Pen—Pending
(r)—By 15⅞ x 14$\frac{1}{16}$ high.

Cylinder Arrangement

Hor—Horizontal Opposed
IV-L—Inverted-In-Line
IV-V—Inverted-V-Type
Rad—Radial

VO—Vertically Opposed

Cylinder Material

(1)—Nickel Iron with Aluminum Head
(2)—Aluminum with Steel Liner
(3)—Cast Iron
(4)—Cast Iron with Aluminum Head
(5)—Steel with Aluminum Head
(6)—Aluminum with cast iron liner
(7)—Steel
(8)—Nickel Iron

Valve Location

In—In head with push rods and rocker arms
OH—Overhead Camshaft

Rating

SL—Sea Level
H—High Blower
L—Lower Blower
M—Main Blower
††—Turbo to 27,000 ft.
†††—Turbo to 30,000 ft.
††††—Turbo to 25,000 ft.
(e)—75% power allowable

Propeller Drive

†—.666 Optional
‡—.4375 Optional

Carburetor Make

Cec—Ceco (Chandler-Evans)
Hol—Holley
MS—Marvel-Schebler
SH—Stromberg or Holley
SM—Stromberg or Marvel-Schebler
Str—Stromberg

Carburetor Type

FL—Floating
NF—Non-floating
PI—Pressure Injection
SF—Semi-automatic Float

Ignition System Make

Bos—Bosch
Scin—Scintilla
Eis—Eisemann
ES—Edison-Splitdorf

Starter Make

AL—Auto-Lite **DR**—Delco-Remy
Ecl—Eclipse **Opt**—Optional
JH—Jack & Heintz
EC—Eclipse or Champion

Method of Starting

EM—Electric Motor
Opt—Optional
PS—Propeller Swing

Engine Manufacturers

(1)—Aircooled Motors Corp.
(2)—Commonwealth Aircraft, Inc.
(3)—Aviation Mfg. Corp., Lycoming Div.
(4)—Built by Packard Motor Co.

Mounting

(s)—A longitudinal type mounting is provided by four mounting bosses integral with the crankcase.

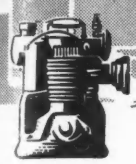
(t)—A rear type mounting is provided by four mounting bosses integral with the crankcase sections.

(u)—A rear type mounting is provided by five mounting bosses, 4 of which are integral with the crankcase sections, and the remaining boss is located at the rear of the oil sump.

New Transatlantic Clipper

Designed for transatlantic service, a contract for a fleet of giant six-engined Clippers—the largest yet proposed—has been placed with Consolidated Vultee Aircraft Corp. by Pan-American World Airways. A model of one is shown here. Carrying a payload of 50,000 lb., comprising 204 passengers and 15,300 lb. of baggage, mail and express, the new Clipper will have a range of 4200 miles. Gross weight is 320,000 lb. Cruising speed varies between 310 and 342 mph. Its wing span is 230 ft., length 182 ft. and height 57 ft. Cabins on the two decks will be conditioned for operation at 30,000 ft. altitude. The time for a New York to London trip will be about nine hours.

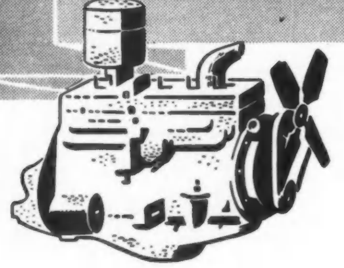
Small Gasoline Power Units



MAKE AND MODEL	Designed for Use	Number of Cycles	ENGINE: Type	No. of Cylinders	Bore and Stroke (In.)	Total Displacement (Cu. In.)	Compression Ratio (to —1)	Valve Location	Horsepower: Rated at RPM	Horsepower: Continuous at RPM	Torque—Lb. Ft. at RPM	Weight (Lb.)	GOVERNOR: Used	GOVERNOR: Type	Ignition System Type	FUEL SYSTEM: Type	FUEL SYSTEM: Make	Fuel Used	Starting Method
AIR COOLED ENGINES																			
Briggs & Stratton (1).....N	GS,Co,Ha,Pu,Re,Af	4	Ver	1	2x2	6.28	5.86	L	1.5-3000	1.7-3600	2.9-3600	38	Y	Pn	Mag	Car	Own	G	Ro
Briggs & Stratton.........A	GS,Co,Ha,Pu,Re,Af	4	Ver	1	2¼x2¼	8.95	4.26	L	1.7-2500	2.0-3200	4.0-3200	76	Y	Me	Mag	Car	Own	G	Ro
Briggs & Stratton.........B	GS,Co,Ha,Pu,Re,Af	4	Ver	1	2⅝x2⅝	14.21	4.47	L	2.7-2400	3.0-3200	6.0-3200	92	Y	Me	Mag	Car	Own	G	Ro
Briggs & Stratton.......ZZ	GS,Co,Ha,Pu,Re,Af	4	Ver	1	3x3¼	22.97	4.76	L	6.0-2600	6.5-3200	12.6-3200	113	Y	Me	Mag	Car	Own	G	Ro
Continental (2)....Tiny Tim	GS,Pu,Re	4	Ver	1	1¾x1¾	4.20	4.13	L	⅝-2400	....	1.4-2400	85	N	.....	Bat	......	......	G	El
Cushman (3)..........M70	Pu,Af,Ag	4	Ver	1	2⅝x2¾	14.89	5.40	L	4.0-3000	4.0-3000	7.5-2800	80	Y	Fb	Mag	Car	Til	G	PB
Cushman..............M50	Pu,Af,Ag	4	Ver	1	2⅝x2½	13.53	5.00	L	2.0-1800	2.0-1800	6.0-1800	75	Y	Fb	Mag	Car	Til	G	PB
Delco (4)............4B12	GS	4	Ver	1	2⅛x2¼	8.00	4.00	L	1.2-2100	0.9-2100	2.9-2100	97	N	.....	Bat	Car	......	G	El
Delco................7B12	GS	4	Ver	1	2 5/16x2¼	9.45	5.00	L	1.6-2300	....	3.8-2300	104	Y	Fb	Bat	Car	......	G	El
Delco................2B12	GS	4	Ver	1	1 11/16x1⅝	3.64	3.40	L	....	0.5-2250	1.1-2250	40	N	.....	Bat	Car	......	G	El
Delco.............10EAB3	GS	4	Ver	1	2¾x2 9/16	15.25	4.50	L	....	1.9-1800	5.4-1800	....	Y	Fb	Bat	Car	......	G	El
Homelite (5)............B	GS	2	Inv	1	2x1½	4.70	6.00	R	1.7-3400	1.7-3400	....	....	Y	Ce	Mag	Car	Til	G	Bp
Homelite............HRU	GS,Ru,Bl	2	Ver	1	2⅜x2⅛	9.40	6.00	R	4.0-3500	4.0-3500	....	....	Y	Ce	Mag	MV	Own	G	Bp
Jacobsen (6)..........J100	GS,Co,Pu,Re,Af,Ha	2	Hor	1	2x1½	4.70	5.50	N	1.0-3000	....	....	....	Y	Av	Mag	Car	Til	G	Rr
Jacobsen..............J150	GS,Co,Pu,Re,Af,Ha	2	Hor	1	2¼x1¾	6.95	5.50	N	1.5-3000	....	....	....	Y	Av	Mag	Car	Til	G	Rr
Jacobsen..............J300	GS,Co,Pu,Re,Af,Ha	2	Hor	1	2¾x2½	14.85	5.50	N	3.0-2600	....	....	....	Y	Av	Mag	Car	Til	G	Rr
Indian (7)............84-A	GS,Co,Pu,Re	4	Vee	2	2⅞x3½	45.44	6.00	L	23.0-4000	15-(f)	27.5-3200	147	Y	Ce	Mag	Car	Lin	G	Pe
Lauson (8)..............RLC	GS,Co,Ha,Pu,Re,Af	4	Ver	1	1¾x1⅞	4.51	5.00	L	0.8-2400	0.7-2400	1.7-2400	30	Y	Fb	Mag	Car	Til	G	Ro
Lauson..................TLC	GS,Co,Ha,Pu,Re,Af	4	Ver	1	2¼x2¼	8.95	5.00	L	1.9-2400	1.6-2400	4.2-2400	65	Y	Fb	Mag	Car	Til	G	Ro
Lauson..................RSC	GS,Co,Ha,Pu,Re,Af	4	Ver	1	2x1⅞	5.89	5.00	L	1.2-2400	0.9-2400	2.5-2400	33	Y	Fb	Mag	Car	Til	G	Ro
Lauson..................PAC	GS,Co,Ha,Pu,Re,Af	4	Ver	1	2⅞x2¾	17.85	5.00	L	4.0-2400	3.6-2400	8.8-2400	85	Y	Fb	Mag	Car	Til	G	Ro
Mall (9)...........17410A	CS	2	Ver	1	2⅜x2¾	12.20	4.90	..	5.0-4000	....	....	52	N	.....	Mag	Car	Brk	G	Bp
Mall...............17410B	CS	2	Ver	1	2⅜x2¾	12.20	5.00	...	6.0-4500	....	....	44	N	.....	Mag	Car	Brk	G	Bp
Mall.................1060	CS	2	Ver	2	2⅜x2¼	19.90	5.00	...	10.0-4000	....	....	55	Y	Ce	Mag	Car	Brk	G	Bp
Novo (10)...........CA-33	GS,Co,Pu,Re,Hs	4	Ver	1	3¼x4	33.00	4.25	L	5.1-1800	4.0-1800	16.0-1400	245	Y	Fb	Mag	Car	Hol	G,K,NgG	.....
Onan (11)................1B	GS	4	Ver	1	2¾x2¾	16.30	4.80	L	2.5-1800	2.5-1800	7.3-1800	†177	Y	‡	Mag	Car	Zen	G	Ro
Onan.....................OTC	GS	4	Op	2	2⅝x2¼	24.35	5.90	L	4.1-2850	3.4-1800	9.9-1800	†155	Y	‡	Mag	Car	Zen	G	Ro
Onan.....................OFA	GS	4	Op	4	2¾x2¼	53.45	6.00	L	9.0-2850	7.5-1800	21.9-1800	365	Y	‡	Bat	Car	MS	G	HE
Onan.......................IC	GS	4	Ver	1	2¼x2¼	8.95	5.00	L	1.4-2100	1.0-1800	2.9-1800	105	Y	‡	Mag	Car	Zen	G	HE
Wisconsin (12).........AA	GS,Co,Pu,Re,Af,In	4	Ver	1	2¼x2¾	10.90	4.40	L	2.0-2600	1.6-2600	4.7-1900	76	Y	.....	Mag	Car	Str	G	B
Wisconsin.................AB	GS,Co,Pu,Re,Af,In	4	Ver	1	2½x2¾	13.50	4.40	L	3.0-2600	2.4-2600	6.7-1700	76	Y	.....	Mag	Car	Str	G	B
Wisconsin...............ABS	GS,Co,Pu,Re,Af,In	4	Ver	1	2½x2¾	13.50	5.17	...	4.0-3200	3.2-3200	6.9-2500	79	Y	.....	Mag	Car	Str	G	B
Wisconsin.................AK	GS,Co,Pu,Re,Af,In	4	Ver	1	2⅞x2¾	17.80	4.60	L	4.1-2400	3.3-2400	9.5-1700	77	Y	.....	Mag	Car	Str	G	B
Wisconsin...............AKS	GS,Co,Pu,Re,Af,In	4	Ver	1	2⅞x2¾	17.80	5.12	...	5.0-3200	4.0-3200	10.0-2000	....	Y	.....	Mag	Car	Str	G	B
Wisconsin...............ADH	GS,Co,Pu,Re,Af,In	4	Ver	1	2¾x3¼	19.30	5.10	L	5.1-2600	4.1-2600	10.8-2000	125	Y	.....	Mag	Car	Str	G	HB
Wisconsin...............AEH	GS,Co,Pu,Re,Af,In	4	Ver	1	3x3¼	23.00	5.10	L	6.1-2800	4.9-2600	12.9-2000	130	Y	.....	Mag	Car	Str	G	HB
Wisconsin...............AGH	GS,Co,Pu,Re,Af,In	4	Ver	1	3½x4	38.50	4.60	L	8.4-2100	6.7-2200	24.2-1300	....	Y	.....	Mag	Car	Str	G	HB
Wisconsin...............AHH	GS,Co,Pu,Re,Af,In	4	Ver	1	3⅝x4	41.30	4.55	L	9.2-2200	7.4-2200	25.9-1400	180	Y	.....	Mag	Car	Str	G	HB
WATER COOLED ENGINES																			
Cushman (3)..........2R14	GS,Co,Pu,Af	4	Hor	1	3¼x4½	37.33	3.67	(a)	2.0-750	2.0-750	18.5-750	195	Y	Fb	Mag	MV	Own	G,K,D,Ng	Hc
Cushman..............3R20	GS,Co,Pu,Af	4	Hor	1	3½x4½	43.29	4.10	(a)	3.0-800	3.0-800	23.0-800	235	Y	Fb	Mag	MV	Own	G,K,D,Ng	Hc
Cushman..............4R30	GS,Co,Pu,Af	4	Hor	1	3¾x4½	49.70	4.64	(a)	4.0-850	4.0-850	28.0-850	245	Y	Fb	Mag	MV	Own	G,K,D,Ng	Hc
Cushman................C34	Co,Pu,Af	4	Ver	1	4x4	50.26	4.00	(a)	(b)	(b)	26.8-1000	270	Y	Fb	Mag	Car	Til	G	Hc
IHC (13).......LB, 3-5 Hp	Pu,Re,Af	4	Hor	1	4x4⅛	51.80	4.60	I	(d)	(d)	35.8-750	290	Y	Fb	Mag	MV	Own	G,K,D,Ng	Hc
IHC.......LB, 1½-2½ Hp	Ha, Pu, Af	4	Hor	1	3⅛x3¼	24.90	4.70	I	(e)	(e)	16.5-875	194	Y	Fb	Mag	MV	Own	G,K,D,Ng	Hc
Le Roi (14)...............V	GS,Pu,Re,Af	4	Ver	2	2⅞x3½	45.4	.....	L	7.8-2000	6.0-1800	22.8-1200	400	Y	Fb	Mag	Car	......	G	HE
Le Roi.....................X	GS,Pu,Af,Mx	4	Ver	4	2⅞x3½	90.8	.....	L	16.0-1800	12.0-1300	47.0-1800	495	Y	Fb	BM	CM	......	G	HE
Le Roi..................D140	GS,Pu,Af	4	Ver	4	3½x3⅝	140.0	.....	I	33.0-2400	23.0-1500	72.0-2400	650	Y	Fb	BM	CM	......	G	HE
Novo (10).........CW-33	GS,Co,Pu,Re,Hs	4	Ver	1	3¼x4	33.00	5.50	L	5.1-1800	4.0-1800	18.5-1200	340	Y	Fb	Mag	Car	Hol	G,K,Ng,G	.....
Novo.................CW-47	GS,Co,Pu,Re,Hs	4	Ver	2	2¾x4	47.00	5.50	L	8.0-1800	6.4-1800	25.7-1200	395	Y	Fb	Mag	Car	Hol	G,K,Ng,G	.....
Novo.................CW-66	GS,Co,Pu,Re,Hs	4	Ver	2	3¼x4	66.00	5.50	L	10.7-1800	8.5-1800	37.5-1200	395	Y	Fb	Mag	Car	Hol	G,K,Ng,G	.....
Novo.................CW-95	GS,Co,Pu,Re,Hs	4	Ver	4	2¾x4	95.00	5.50	L	15.6-1800	....	50.4-1200	540	....	.....	Mag	Car	Hol	G,K	.....
Novo...............CW-133	GS,Co,Pu,Re,Hs	4	Ver	4	3¼x4	133.0	5.50	L	24.0-1800	....	86.5-1200	540	....	.....	Mag	Car	Hol	G,K	.....
Onan (11).......W3M or S	GS	4	IL	2	3x2¾	38.80	5.50	L	7.2-1850	7.1-1800	20.4-1850	†450	Y	‡	BM	Car	Zen	G	Hc
Onan......................V45	GS	4	Vee	4	3x2¾	77.80	5.50	L	14.5-1800	14.5-1800	42.3-1800	†640	Y	.....	BM	Car	Zen	G	Hc
Universal (15).......AFTC	GS	4	Ver	2	3x3½	49.50	5.79	L	5.0-1200	....	25.0-1200	385	Y	Me	BM	Car	Str	G	HE

ABBREVIATIONS

†—Weight includes generator
‡—Flyweights in cam gear
(a)—"F" Head; In-Head for Intake, L-head for exhaust
Af—Auxiliary Farm Implement equipment
Ag—Auto glides
Av—Air Vane
B—Belt
(b)—4 to 6 Hp at 850 to 1300 rpm
Bat—Battery
Bl—Blowers
BM—Battery and Magneto
Bp—Belt or Pulley
Brk—Bracke
Car—Carburetor
Ce—Centrifugal
CM—Carburetor or Mixing Valve
Co—Air Compressors
CS—Chain Saws
D—Distillate
(d)—3 to 5 Hp at 600 to 1000 rpm
(e)—1½ to 2½ Hp at 600 to 1000 rpm
El—Electric
(f)—3600 to 4000 rpm
Fb—Flyball throttling
G—Gasoline
GS—Generator Sets
Ha—Home appliances
HB—Hand crank or Belt
Hc—Hand crank
HE—Hand crank or electric
Hol—Holley Carburetor Co.
Hor—Horizontal
Hs—Hoists
I—In-head
IL—In Line
In—Industrial
Inv—Inverted
K—Kerosene
L—Valves at side (L-Head)
Lin—Linkert
Mag—Magneto
Me—Mechanical
MS—Marvel-Schebler Carburetor Div.
MV—Mixing Valve
MX—Mixers
N—No or None
Ng—Natural gas
NgG—Combination gas and gasoline
Op—Opposed
PB—Pedal or Belt or Pulley
Pe—Pedal
Pu—Pumps
Pn—Pneumatic
R—Rotary valves
Re—Refrigerating equipment
Ro—Rope
Rr—Recoil or Rope
Str—Stromberg Carburetor Div.
Til—Tillotsen Mfg. Co.
Ver—Vertical
Y—Yes
Zen—Zenith Carburetor Div.
(1)—Briggs & Stratton Corp.
(2)—Continental Motors Corporation
(3)—Cushman Motor Works
(4)—Delco Applicance Division
(5)—Homelite Corporation
(6)—Jacobsen Mfg. Co.
(7)—Indian Motorcycle Company
(8)—The Lauson Company
(9)—Mall Tool Company
(10)—Novo Engine Company
(11)—D. W. Onan & Sons
(12)—Wisconsin Motor Corp.
(13)—International Harvester Co.
(14)—Le Roi Company
(15)—Universal Motor Company



AMERICAN

Line Number	Engine Make and Model	Designed for	Number of Cylinders, Bore and Stroke (In.)	Maximum Brake Hp. at Specified R.P.M.: With Bare Engine	Maximum Brake Hp. at Specified R.P.M.: With Standard Accessories	Piston Displacement (Cu. In.)	Compression Ratio	Maximum Torque at R.P.M. (Lb. Ft.) with or without Accessories	Cylinder Liners—Type	Crankcase—Upper Half Integral with Cylinders	Valves: Arrangement	Valves: Exhaust Head Material (S.A.E. No.)	Valves: Max. Head Diameter (In.) Intake	Valves: Max. Head Diameter (In.) Exhaust	Valves: Min. Port Diameter (In.) Intake	Valves: Min. Port Diameter (In.) Exhaust	Valves: Lift (In.) Intake	Valves: Lift (In.) Exhaust	Valves: Stem Diameter (In.) Intake	Valves: Stem Diameter (In.) Exhaust
1	Allis-Chalmers B-15	Tr,Ind	4-3⅜x3½	30-1800	28-1800	125.0	5.75	87-1100 (EA)	W	In	I	Sil	1.43	1.31	1.20	1.03	.378	.378	.344	.344
2	Allis-Chalmers W-25	Tr,Ind	4-4x4	44-1800	40-1800	201.1	5.00	128-1200 (EA)	W	In	I	Sil	1.68	1.50	1.50	1.32	.376	.376	.372	.372
3	Allis-Chalmers U-40	Tr,Ind	4-4½x5	56-1400	51-1400	318.0	4.75	200-900 (EA)	W	In	I	Sil	2.03	1.78	1.75	1.50	.375	.375	.372	.372
4	Allis-Chalmers E-60	Tr,Ind	4-5¼x6½	86-1200	78-1200	563.0	5.20	400-650 (EA)	W	In	I	Sil	2.00	2.00	2.00	2.00	.440	.417	.500	.500
5	Allis-Chalmers L-90	Tr,Ind	6-5¼x6½	128-1200	117-1200	844.0	5.20	590-650 (EA)	W	In	I	Sil	2.21	2.21	2.00	2.00	.440	.417	.500	.500
6	Autocar 377	T	6-4x5	119-2800	112-2800	377.0	5.85	280-1400 (BE)	N	Se	L	Sil X10	1.90	1.78	1.63	1.56	.406	.406	.437	.437
7	Autocar 447	T	6-4¼x5¼	133-2500	122-2500	447.0	5.75	351-1100 (BE)	N	Se	L	Sil X10	2.06	1.93	1.87	1.75	.406	.406	.437	.437
8	Autocar 501	T	6-4½x5¼	145-2500	134-2500	501.0	5.75	395-950 (BE)	N	Se	L	Sil X10	2.06	1.93	1.87	1.75	.406	.406	.437	.437
9	Brennan Imp. De Luxe	M	4-2x3	20-3900	15-3900	45.0	7.00	31-2500 (EA)	N	Se	I	Sil	1.00	1.00	.875	.875	.250	.250	.312	.312
10	Brennan 20	Ind	4-2¼x3⅛	20-3900	15-3900	50.0	7.40	34-3200 (EA)	N	Se	L	Sil	1.12	1.00	.875	.875	.250	.250	.312	.312
11	Brennan Imp. De Luxe Spec.	M	4-2¼x3⅛	25-4000	20-4000	50.0	7.40	34-3200 (EA)	N	Se	I	Sil	1.12	1.00	.875	.875	.250	.250	.312	.312
12	Brennan M-4	M	4-4x5	45-1800	38-1800	251.0	5.00	155-1000 (EA)	N	Se	L	NCI								
13	Brennan CE	Ind	4-4½x5	54-1600	45-1600	318.0	5.00	203-1000 (EA)	N	Se	L	Sil	2.00	2.00	1.87	1.87	.375	.375	.375	.375
14	Brennan E-4	M	4-4½x5	54-1600	45-1600	318.0	5.00	203-1000 (EA)	N	Se	L	Sil	2.00	2.00	1.87	1.87	.375	.375	.375	.375
15	Brennan B-70	T,B,Tr,Ind	6-4x5½	90-2000	75-2000	415.0	4.50	278-900 (EA)	N	Se	I	Sil	2.12	2.12	2.00	2.00	.375	.375	.437	.437
16	Brennan 100	M	6-4x5½	94-2000	80-2000	415.0	6.00	278-900 (EA)	N	Se	I	Sil	2.12	2.12	2.00	2.00	.375	.375	.437	.437
17	Brennan B-100	T,B,Tr,Ind	6-4⅜x5½	94-2000	80-2000	496.0	4.50	350-1200 (EA)	N	Se	I	Sil	2.12	2.12	2.00	2.00	.375	.375	.437	.437
18	Brennan 125	M	6-4⅜x5½	110-2200	94-2200	496.0	6.00	350-1200 (EA)	N	Se	I	Sil	2.12	2.12	2.00	2.00	.375	.375	.437	.437
19	Brennan 150	M	6-4½x6½	150-2000	130-2000	620.3	6.00	500-1200 (EA)	N	Se	I	Sil	2.50	2.50	2.12	2.12	.437	.437	.500	.500
20	Brennan Imp	M	4-2½x3⅛	23-3000	22-3000	61.4	7.50	28-1200 (BE)	N	Se	L	Sil	1.12	1.12	1.00	1.00	.250	.250	.312	.312
21	Bridgeport F-5	M	1-3¾x4½		6-1200	49.0			N	In	I	Sil	1.50	1.50					.312	.312
22	Bridgeport 71	M	1-5½x6½		10-600	154.0			N	Se	L	NCI	2.25	2.25	2.00	2.00			.500	.500
23	Bridgeport F-10	M	2-3¾x4½		12-1200	99.0			N	In	I	Sil	1.50	1.50					.312	.312
24	Bridgeport 162	M	2-5½x6½		20-650	308.0			N	Se	L	NCI	2.25	2.25	2.00	2.00			.500	.500
25	Bridgeport 182	M	2-6½x7½		25-500	497.0			N	Se	L	NCI	2.37	2.37	2.00	2.00			.500	.500
26	Bridgeport 243	M	3-6½x7½		40-500	746.0			N	Se	L	NCI	2.37	2.37	2.00	2.00			.500	.500
27	Bridgeport Pilot	M	4-4¼x5		55-2000	283.0		225-2000 (EA)	N	In	L	Sil	1.87	1.87	1.62	1.62			.375	.375
28	Bridgeport 304	M	4-5½x6½		45-700	617.0			N	Se	L	NCI	2.25	2.25	2.00	2.00			.500	.500
29	Bridgeport 404	M	4-6½x7½		65-600	995.0			N	Se	L	NCI	2.37	2.37	2.00	2.00			.500	.500
30	Buda HP-217	T,Tr	4-3 13/16x4¾	55-2400	47-2400	217.0	5.50	123-1200 (EA)	N	In	L	2112	1.65	1.53	1.50	1.37	.344	.344	.372	.372
31	Buda 4HM-217-MD	M	4-3 13/16x4¾		56-2400	217.0	5.70	148-1400 (EA)	N	In	L	2112	1.65	1.53	1.50	1.37	.344	.344	.372	.372
32	Buda 4HM-217-MHD	M	4-3 13/16x4¾		48-1800	217.0	5.70	146-1400 (EA)	N	In	L	2112	1.65	1.53	1.50	1.37	.344	.344	.372	.372
33	Buda 4HM-217-HD	M	4-3 13/16x4¾		30-1200	217.0	5.70	131-1200 (EA)	N	In	L	2112	1.65	1.53	1.50	1.37	.344	.344	.372	.372
34	Buda HP-234	T,Tr	4-3 13/16x5⅛	59-2400	50-2400	234.0	5.83	133-1200 (EA)	N	In	L	2112	1.65	1.53	1.50	1.37	.344	.344	.372	.372
35	Buda FRH	T,B,Tr	4-5½x6½	78-1200	66-1200	618.0	4.60	350-600 (EA)	N	Se	L	2112	2.50	2.50	2.25	2.25	.375	.375	.434	.434
36	Buda JL-877	Tr,Ind	4-6¼x7⅛	122-1200	104-1200	874.0	4.80	535-700 (EA)	N	Se	L	2112	2.93	2.50	2.50	2.50	.375	.375	.497	.497
37	Buda HP-260	T,B	6-3½x4½	68-2800	58-2800	260.0	4.75	139-1100 (EA)	N	In	L	2112	1.65	1.53	1.50	1.37	.344	.344	.372	.372
38	Buda HP-298	T,B,Tr	6-3¾x4½	77-2800	65-2800	293.0	4.75	161-1100 (EA)	N	In	L	2112	1.65	1.53	1.50	1.37	.344	.344	.372	.372
39	Buda HP-326	T,B,Tr	6-3 13/16x4¾	78-2400	66-2400	326.0	5.40	188-1000 (EA)	N	In	L	2112	1.65	1.53	1.50	1.37	.344	.344	.372	.372
40	Buda HP-351	T,Tr	6-3 13/16x5⅛	84-2400	71-2400	351.0	5.83	201-1000 (EA)	N	In	L	2112	1.65	1.53	1.50	1.37	.344	.344	.372	.372
41	Buda 6HM-326-MD	M	6-3 13/16x4¾	80-2400	80-2400	326.0	5.70	225-900 (EA)	N	In	L	2112	1.65	1.53	1.50	1.37	.344	.344	.372	.372
42	Buda 6HM-326-MHD	M	6-3 13/16x4¾		70-1800	326.0	5.70	225-900 (EA)	N	In	L	2112	1.65	1.53	1.50	1.37	.344	.344	.372	.372
43	Buda 6HM-326-HD	M	6-3 13/16x4¾		46-1200	326.0	5.70	200-900 (EA)	N	In	L	2112	1.65	1.53	1.50	1.37	.344	.344	.372	.372
44	Buda K-393	T,B,Tr	6-4 3/16x4¾	101-2400	86-2400	393.0	4.80	216-1100 (EA)	N	In	L	2112	1.90	1.78	1.75	1.62	.400	.400	.372	.372
45	Buda K-428	T,B,Tr	6-4⅜x4¾	107-2400	91-2400	428.0	5.33	240-1100 (EA)	N	In	L	2112	1.90	1.78	1.75	1.62	.400	.400	.372	.372
46	Buda 6KM-428-MD	M	6-4⅜x4¾		110-2400	428.0	5.50	299-1200 (EA)	N	In	L	2112	1.90	1.78	1.75	1.62	.400	.400	.372	.372
47	Buda 6KM-428-MHD	M	6-4⅜x4¾		96-1800	428.0	5.50	299-1200 (EA)	N	In	L	2112	1.90	1.78	1.75	1.62	.400	.400	.372	.372
48	Buda 6KM-428-HD	M	6-4⅜x4¾		60-1200	428.0	5.50	278-900 (EA)	N	In	L	2112	1.90	1.78	1.75	1.62	.400	.400	.372	.372
49	Buda L-525	T,B,Tr	6-4½x5½	110-2400	94-2400	525.0	4.75	287-800 (EA)	N	In	L	2112	1.90	1.78	1.75	1.62	.400	.400	.372	.372
50	Buda LO-525	T,B,Tr	6-4½x5½	135-2400	115-2400	525.0	5.00	330-1100 (EA)	N	In	I	2112	1.96	1.68	1.75	1.50	.468	.468	.372	.372
51	Buda JL-1335	Tr,Ind	6-6¼x7¼	164-1000	140-1000	1334.6	4.40	780-600 (EA)	N	Se	L	2112	2.93	2.93	2.50	2.50	.438	.438	.497	.497
52	Buda PC-1879	Ind	6-6¾x8¾	232-1000	197-1000	1879.0	4.50	1110-750 (EA)	W	In	I	2112	2.71	2.53	2.50	2.28	.703	.703	.558	.558
53	Buda PCG-1879	Ind	6-6¾x8¾	232-1000	197-1000	1879.0		1200-750 (EA)	W	In	I	2112	2.71	2.53	2.50	2.28	.703	.703	.558	.558
54	Buda 6-MO-970	T,B,Tr,R,M	6-5⅝x6½	172-1400	147-1400	970.0	5.43	545-1000	W	In	I	2112	2.64	2.02	2.37	1.87	.540	.540	.433	.433
55	Buda 6-MO-893	T,B,Tr,R,M	6-5⅝x6	199-2000	170-2000	893.0	5.50	490-1000	W	In	I	2112	2.64	2.02	2.37	1.87	.540	.540	.433	.433
56	Buffalo RA-4	M,Ind	4-5⅞x7	120-1200	110-1200	759.0	4.60	525-1200 (EA)	N	Se	I	Sil	3.09	2.84	2.87	2.62	.540	.540	.500	.500
57	Buffalo RAB-4	M,Ind	4-6½x7	145-1200	130-1200	929.0	5.00	635-1200 (EA)	N	Se	I	Sil	3.09	2.84	2.87	2.62	.625	.540	.500	.500
58	Buffalo RA-6	M,Ind	6-5⅞x7	180-1200	160-1200	1138.0	4.60	790-1200 (EA)	N	Se	I	Sil	3.09	2.84	2.87	2.62	.540	.540	.500	.500
59	Buffalo RAB-6	M,Ind	6-6½x7	215-1200	195-1200	1393.0	5.00	955-1200 (EA)	N	Se	I	Sil	3.09	2.84	2.87	2.62	.625	.540	.500	.500
60	Buffalo RA-8	M,Ind	8-5⅞x7	240-1200	220-1200	1518.0	4.60	1050-1200 (EA)	N	Se	I	Sil	3.09	2.84	2.87	2.62	.540	.540	.500	.500
61	Buffalo RAB-8	M,Ind	8-6½x7	300-1200	270-1200	1858.0	5.00	1275-1200 (EA)	N	Se	I	Sil	3.09	2.84	2.87	2.62	.625	.540	.500	.500
62	Chevrolet 1942	T,B	6-3 9/16x3 15/16	93-3100	83.5-3000	235.5	6.62	182-1000 (EA)	N	In	I	AS	1.64	1.46	1.25	1.20	.294	.312	.341	.340
63	Chris-Craft ■B	M	4-3¼x4		60-3200	132.7	7.50	108-2400 (EA)	N	In	L	CNS	1.50	1.37	1.25	1.12	.312	.312	.310	.310
64	Chris-Craft ■▼K	M	6-3 7/16x4⅛		95-3200	229.7	7.35	173-1800 (EA)	N	In	L	CNS	1.60	1.39	1.46	1.25	.312	.312	.310	.310
65	Chris-Craft ■▼M	M	6-4x4¼		130-3000	320.4	7.50	239-2400 (EA)	N	In	L	Sil	1.87	1.78	1.71	1.56	.356	.356	.372	.372
66	Chris-Craft ■▼W	M	6-4¼x4¾		160-3000	404.3	6.40	322-1500 (EA)	N	In	L	AUS	2.06	1.87	1.81	1.62	.388	.388	.372	.372
67	Chrysler ■▼Ace-M6	M	6-3¼x4⅜		† 92-3200	217.7	6.60	180-1200 (EA)	N	In	L	Sil	1.53	1.41	1.31	1.28	.371	.369	.340	.340
68	Chrysler ■▼Crown-M7	M	6-3 7/16x4½		†115-3200	250.6	6.60	205-1200 (EA)	N	In	L	Sil	1.72	1.53	1.44	1.37	.371	.369	.340	.340
69	Chrysler ■▼Royal-M8	M	8-3¼x4⅞		†141-3200	323.5	6.80	270-2000 (EA)	N	In	L	Sil	1.53	1.35	1.34	1.22	.371	.369	.340	.340
70	Climax N4B	Ind	4-5¾x6½	102-1200	90-1200	675.0	4.30	490-700 (EA)	N	In	I	Sil	2.50	2.50	2.25	2.25	.500	.500	.562	.562
71	Climax R41	Ind	4-6x7	123-1200	112-1200	791.6	4.70	525-750 (EA)	N	Se	I	Sil	2.50	2.50	2.25	2.25	.500	.500	.562	.562
72	Climax R61	Ind	6-6x7	183-1200	165-1200	1187.4	4.70	802-700 (EA)	N	Se	I	CNS	2.50	2.50	2.25	2.25	.500	.500	.562	.562
73	Climax R81	Ind	8-6x7	245-1200	221-1200	1583.2	4.70	1085-750 (EA)	N	Se	I	Sil	2.50	2.50	2.25	2.25	.500	.500	.562	.562
74	Climax V-425	Ind	12-6½x7	425-1200	380-1200	2787.0	4.90	2120-750	W	Se	I	Sil	2.81	2.68	2.50	2.37	.687	.687	.562	.562
75	Climax V-495	Ind	12-7x7	495-1200	445-1200	3232.0	4.90	2460-750	W	Se	I	Sil	2.81	2.68	2.50	2.37	.687	.687	.562	.562
76	Climax V-260	Ind	8-6½x7			1860.0	4.90		W	Se	I	Sil	2.81	2.69	2.50	2.37	.687	.687	.562	.562
77	Climax V-330	Ind	8-7x7			2155.0	4.90		W	Se	I	Sil	2.81	2.68	2.50	2.37	.687	.687	.562	.562

(For abbreviations see pages 66 and 67)

GASOLINE ENGINES

Stem Diameter (In.)	VALVES				PISTONS				CONNECTING RODS			CRANKSHAFT								CARBURETOR			OVERALL DIMENSIONS (In.)			
	Seats													Crank-Pin	MAIN BEARINGS											
																Diameter and Length (In.)										
Exhaust	Angle (Deg.)	Inserts Used?	Insert Material (S.A.E. No.)	Camshaft Drive—Type	Material	Weight with Pins, Rings, Bushings (Oz.)	Piston Pin—Diameter and Length (In.)	Number of Rings per Piston	Material	Center to Center Length (In.)	Weight with Bushing and Cap (Oz.)	Material	Counter Balance Used	Diameter and Length (In.)	Number	Front	Rear	Oil Pressure to—	Spark Plug—Thread Size	Make	Size	Engine Weight without Carburetor or Ignition (Lb.)	Width	Height	Length	Line Number
.344	45	N	.....	HG	CI	42	.813x2.87	4	1040	6½	29	1045	N	1.93x1.43	3	2.25x1.62	2.25x1.50	aceg	14mm	Zen	⅞	360	16 5/16	31⅝	27	1
.372	45	E	TA	HG	CI	67	.989x3.50	4	1040	7½	42	1045	N	2.37x1.75	3	2.43x1.93	2.50x1.75	abcdeg	14 mm	Zen	1	520	23	31⅜	33½	2
.372	30	E	TA	HG	CI	99	1.31x4.06	5	1045	9½	92	1045	N	2.37x2.37	3	2.50x2.31	2.50x2.75	abcdeg	⅞-18	Zen	1¼	985	26	37½	43¾	3
.500	45	E	TA	HG	CI	162	1.50x4.87	4	1040	13	182	1045	N	2.75x3.24	3	3.00x3.50	3.00x4.75	abcdeg	⅞-18	Zen	1½	2020	27	47⅞	53	4
.500	45	E	TA	HG	CI	162	1.50x4.87	4	1040	13	182	1945	N	2.75x3.24	4	3.00x3.50	3.00x4.75	abcdeg	⅞-18	Zen(2)	1½	2810	29¾	63 3/16	72½	5
.437	45	E	71360	HG	Al	43	1.12x3.43	4	2340	10⅛	65	1050	N	2.37x1.44	7	3.25x1.87	3.25x2.60	abcde	18 mm	Zen	1¼	1165	27½	41	45	6
.437	45	E	71360	HG	Al	51	1.12x3.68	4	2340	10¼	78	CS	N	2.50x1.58	7	3.25x1.87	3.25x2.87	abcde	18 mm	Str	1¾	1320	27½	41½	47	7
.437	45	E	71360	HG	Al	57	1.12x3.93	4	2340	10¼	78	CS	N	2.50x1.58	7	3.25x1.87	3.25x2.87	abcde	18 mm	Str	1¾	1330	27½	41½	47	8
.312	45	N	.....	HG	Al	6	.625x1.87	3	1045	5¾	14	1045	N	1.31x1.25	2	2.50x1.50	2.50x1.50	abcde	14 mm	Tii	¾	160	12¾	17⅝	29	9
.312	45	N	.....	HG	Al	6	.625x2.00	3	1045	5¾	14	1045	Y	1.31x1.25	3	2.50x1.50	2.50x1.50	abcde	14 mm	Zen	¾	128	12¾	17⅝	18¾	10
.312	45	N	.....	HG	Al	6	.625x2.00	3	1045	5¾	14	1045	N	1.31x1.25	3	2.50x1.50	2.50x1.50	abcde	.....	Zen	13/16	165	12¾	17⅝	29	11
.....				HG	CI	.....	1.17x4.00	4	AS	11	.....	CNS	N	2.56x2.00	3	2.12x4.25	2.12x2.25	abcd	.....	Str	1¼	650	12 7/16	19½	53¾	12
.375	45	N	.....	HG	SS	80	1.17x4.00	4	1045	11	64	1045	N	2.50x2.50	3	2.50x4.25	2.50x3.50	abcde	.....	Str	1¼	600	21	29¾	37⅛	13
.375	45	N	.....	HG	SS	72	1.17x4.00	5	1045	11	64	1045	N	2.50x2.50	3	2.50x4.25	2.50x3.50	abcder	.....	Str	1¼	950	16	18	53	14
.437	45	N	.....	HG	SS	64	1.17x3.87	4	CNS	11	65	CNS	N	2.50x2.00	3	2.75x4.50	2.75x3.00	abce	.....	Str	1½	800	25¾	33¾	49	15
.437	45	N	.....	HG	SS	64	1.17x3.87	4	AS	.....	.....	CNS	N	2.50x2.00	3	2.75x4.50	2.75x3.00	abcdeg	.....	Str	1½	800	19¾	24¾	65	16
.437	45	N	.....	HG	SS	76	1.25x3.87	5	CNS	11	65	CNS	N	2.50x2.00	3	2.75x4.50	2.75x3.00	abce	.....	Str	1½	875	25¾	33¾	49	17
.437	45	N	.....	HG	SS	70	1.25x3.87	5	AS	11	65	CNS	N	2.50x2.00	3	2.75x4.50	2.75x4.50	abcdeg	.....	Str	1½	900	19¾	24¾	65	18
.500	45	N	.....	BG	SS	72	1.37x4.00	5	AS	12	80	CNS	Y	2.62x2.67	7	2.62x5.00	2.62x3.50	abcd	.....	Str	1¾	1450	20	30	74	19
.312	45	N	.....	HG	Al	6.5	.625x2.18	3	1045	6	14	1045	.....	1.31x1.25	3	1.31x1.62	1.31x2.00	abce	14 mm	Zen	¾	172	14½	16	20¾	20
.312	45	N	.....	SG	CI	.....	.750x3.37	3	DFS	.....	.....	.....	Y	1.37x1.50	2	1.37x2.50	1.37x2.50	Splash	⅞-18	.....	1	204	13	24	30	21
.500	45	N	.....	SG	CI	124	1.25x5.25	5	DFS	12½	136	.....	N	2.00x3.00	2	2.00x3.00	2.00x5.50	Splash	⅞-18	.....	1¼	510	20	34	47	22
.312	45	N	.....	HG	CI	.....	.750x3.37		DFS	.....		.....	Y	1.37x1.50	2	1.37x1.50	1.37x2.50	Splash	⅞-18	.....	1¼	308	13	25	33	23
.500	45	N	.....	HG	CI	124	1.25x5.25	5	DFS	12½	136	.....	N	2.00x3.00	3	2.00x5.50	2.00x5.50	ML	⅞-18	.....	1¼	1010	20	35	56	24
.500	45	N	.....	SG	CI	272	1.50x6.00	5	DFS	15½	208	.....	N	2.37x3.00	5	2.37x6.00	2.37x6.00	ML	⅞-18	.....	1½	.....	21	40	63	25
.500	45	N	.....	HG	CI	272	1.50x6.00	5	DFS	15½	208	.....	N	2.37x3.00	4	2.37x6.00	2.37x6.00	ML	⅞-18	.....	1½	2000	21	40	77	26
.375	45	Bo	AS	HG	CI	64	1.37x3.50	4	DFS	9½	56	.....	N	2.00x2.25	3	2.00x3.00	2.00x3.25	abcde	⅞-18	.....	1¼	920	17	28½	53	27
.500	45	N	.....	HG	CI	124	1.25x5.25	5	DFS	12½	136	.....	N	2.00x3.00	5	2.00x5.50	2.00x5.50	ML	⅞-18	.....	1½	1700	20	35	76	28
.500	45	N	.....	HG	CI	272	1.50x6.00	5	DFS	15½	208	.....	N	2.37x3.00	5	2.37x6.00	2.37x6.00	ML	⅞-18	.....	1½	2400	21	40	87	29
.372	45	N	.....	HG	CI	42	1.12x3.22	4	CS	9½	42	CS	N	2.12x1.62	5	3.00x1.50	3.00x2.12	abcde	18 mm	Zen	1¼	590	25¾	31 1/16	38 9/32	30
.372	45	N	.....	HG	CI	42	1.12x3.22	4	CS	9½	42	CS	N	2.12x1.62	5	3.00x1.50	3.00x2.12	abcder	18 mm	Str	1¼	770	23¼	31 1/16	43⅜	31
.372	45	N	.....	HG	CI	42	1.12x3.22	4	CS	9½	42	CS	N	2.12x1.62	5	3.00x1.50	3.00x2.12	abcder	18 mm	Str	1¼	770	23¼	31 1/16	43⅜	32
.372	45	N	.....	HG	CI	42	1.12x3.22	4	CS	9½	42	CS	N	2.12x1.62	5	3.00x1.50	3.00x2.12	abcder	18 mm	Str	1¼	770	23¼	31 1/16	43⅜	33
.372	45	N	.....	HG	CI	42	1.12x3.22	4	CS	9½	42	CS	N	2.12x1.62	5	3.00x1.50	3.00x2.12	abcde	18 mm	Str	1¼	770	23¼	31 1/16	43⅜	34
.434	45	E	DC	HG	CI	144	1.37x4.87	4	AS	14⅜	163	CS	N	2.50x3.12	3	2.25x4.12	2.62x4.69	abcde	⅞-18	Zen	1½	1430	28¾	40 7/16	52 9/16	35
.497	30	E	DC	HG	CI	199	2.00x5.33	4	AS	14⅝	227	CS	N	3.00x3.31	3	3.00x4.75	3.00x4.75	abcde	⅞-18	Zen	1¾	1925	30	40	58½	36
.372	45	N	.....	HG	CI	37	1.12x2.97	4	CS	9½	42	CS	N	2.12x1.62	7	3.00x1.50	3.00x2.12	abcde	18 mm	Zen	1½	825	25¾	33 1/16	39 23/32	37
.372	45	N	.....	HG	CI	42	1.12x3.25	4	CS	9½	42	CS	N	2.12x1.62	7	3.00x1.50	3.00x2.12	abcde	18 mm	Zen	1½	825	25¾	33 1/16	39 23/32	38
.372	45	N	.....	HG	CI	42	1.12x3.25	4	CS	9½	42	CS	N	2.12x1.62	7	3.00x1.50	3.00x2.12	abcde	18 mm	Zen	1½	885	25¾	33 1/16	39 23/32	39
.372	45	N	.....	HG	CI	42	1.12x3.25	4	CS	9½	42	CS	N	2.12x1.62	7	3.00x1.50	3.00x2.12	abcde	18 mm	Zen	1½	905	25¾	33 1/16	39 23/32	40
.372	45	N	.....	HG	CI	42	1.12x3.25	4	CS	9½	42	CS	N	2.12x1.62	7	3.00x1.50	3.00x2.12	abcder	18 mm	Str	1½	1010	22⅝	28 11/16	54½	41
.372	45	N	.....	HG	Al	42	1.12x3.25	4	CS	9½	42	CS	N	2.12x1.62	7	3.00x1.50	3.00x2.12	abcder	18 mm	Str	1½	1010	22⅝	28 11/16	54½	42
.372	45	N	.....	HG	Al	42	1.12x3.25	4	CS	9½	42	CS	N	2.12x1.62	7	3.00x1.50	3.00x2.12	abcder	18 mm	Str	1½	1010	22⅝	28 11/16	54½	43
.372	45	N	.....	HG	CI	66	1.25x3.47	4	CS	9½	58	CS	N	2.37x1.75	7	3.00x1.75	3.00x2.50	abcde	18 mm	Zen	1¾	905	25¾	30 11/32	47 9/32	44
.372	45	N	.....	HG	Al	68	1.25x3.82	4	CS	9½	58	CS	N	2.37x1.75	7	3.00x1.75	3.00x2.50	abcde	18 mm	Zen	1¾	905	25¾	30 11/32	47 9/32	45
.372	45	N	.....	HG	CI	68	1.25x3.82	4	CS	9½	58	CS	N	2.37x1.75	7	3.00x1.75	3.00x2.50	abcder	18 mm	Str	1¾	1320	24 13/16	29½	60 11/16	46
.372	45	N	.....	HG	CI	68	1.25x3.82	4	CS	9½	58	CS	N	2.37x1.75	7	3.00x1.75	3.00x2.50	abcder	18 mm	Str	1¾	1320	24 13/16	29½	60 11/16	47
.372	45	N	.....	HG	CI	68	1.25x3.82	4	CS	9½	58	CS	N	2.37x1.75	7	3.00x1.75	3.00x2.50	abcder	18 mm	Str	1¾	1320	24 13/16	29½	60 11/16	48
.372	45	E	DC	HG	CI	88	1.25x3.81	4	CS	11	66	CS	N	2.37x1.75	7	3.00x1.75	3.00x2.50	abcde	18 mm	Zen	1¾	950	25¾	33 7/32	47 9/32	49
.372	30	E	JM	HG	Al	88	1.25x3.81	5	AS	11	78	CS	N	2.37x1.75	7	3.00x1.75	3.00x2.50	abcdeg	14 mm	Zen	1¾	1195	27 9/16	38 27/32	49⅜	50
.497	30	E	DC	HG	CI	199	2.00x5.33	4	AS	15¼	239	CS	Y	3.50x3.31	4	3.50x4.75	3.50x4.75	abcde	⅞-18	Zen	2	3700	28⅝	43	74 1/16	51
.558	45	E	DC	HG	Ala	263	2.75x5.53	5	CS	17¾	430	CS	Y	4.25x3.25	7	4.50x2.68	3.75x3.48	abcdeg	18 mm	Zen(2)	2	9000	48	48 5/16	86 5/32	52
.558	45	E	DC	HG	Ala	263	2.75x5.53	5	CS	17¾	430	CS	Y	4.25x3.25	7	4.50x2.68	3.75x3.48	abcdeg	18 mm	Zen(2)	2	9000	48	68 5/16	86 5/32	53
.433	30	E	Jad	HG	CI	152	1.75x4.75	5	1040	12½	171	1045	N	3.25x2.12	7	3.75x3.75	3.75x2.75	abcdeg	14 mm	Zen	2	2400	48¼	58⅛	53⅛	54
.433	30	E	Jad	HG	CI	152	1.75x4.75	5	1040	12½	171	1045	N	3.25x2.12	7	3.75x3.00	3.75x2.75	abcdeg	14 mm	Zen	2	2400	28½	49¼	58⅛	55
.500	45	E	SA	HG	Al	132	1.50x5.62	5	3135	14	147	3140	Y	3.00x2.37	5	3.75x4.12	3.75x4.50	abce	⅞-18	Zen	2½	2500	24	46	78	56
.500	45	E	SA	HG	Al	154	1.68x6.25	5	3135	14	147	3140	Y	3.00x2.37	5	3.75x4.12	3.75x4.50	abe	⅞-18	Zen	2½	2700	24	46	78	57
.500	45	E	SA	HG	Al	132	1.50x5.62	5	3135	14	147	3140	Y	3.00x2.37	7	3.75x4.12	3.75x4.50	abe	⅞-18	Zen(2)	2	3000	24	46	94	58
.500	45	E	SA	HG	Al	154	1.68x6.25	5	3135	14	147	3140	Y	3.00x2.37	7	3.75x4.12	3.75x4.50	abe	⅞-18	Zen(2)	2	3200	24	46	94	59
.500	45	E	SA	HG	Al	132	1.50x5.62	5	3135	14	147	3140	Y	3.00x2.37	9	3.75x4.12	3.75x4.50	abe	⅞-18	Zen(2)	2½	4000	24	46	111	60
.500	45	E	SA	HG	Al	154	1.68x6.25	5	3135	14	147	3140	Y	3.00x2.37	9	3.75x4.12	3.75x4.50	abe	⅞-18	Zen(2)	2½	4300	24	46	111	61
.340	30	N	.....	HG	CI	38	.864x3.15	3	DFS	6 13/16	31	DFS	Y	2.31x1.5	4	2.69x1.19	2.78x1.62	abcg	10 mm	Car	1¼	560	21	29¾	39.14	62
.310	30	N	.....	HG	Al	21	.750x2.87	3	3140	6 5/16	22	1045	N	1.75x1.12	3	1.98x1.62	1.98x1.62	abr	14 mm	Zen	1¼	456*	24⅛	23 1/16	31 11/16	63
.310	30	N	.....	HG	Ala	25	.875x2.87	3	1035	7	29	1045	N	1.98x1.12	7	2.49x1.93	2.49x1.37	abr**	14 mm	Zen	1⅜	626*	24⅛	25½	40	64
.372	30	N	.....	HG	Ala	36	1.00x3.50	3	1040	8	40	1045	N	1.98x1.50	7	2.49x2.12	2.49x1.37	abr	14 mm	Zen	1¾	850*	26 5/16	27 9/32	46 3/16	65
.372	30	N	.....	HG	Ala	44	1.12x3.68	4	3140	8⅞	52	1045	Y	2.24x1.50	7	2.62x2.75	2.62x1.75	aber	14 mm	Zen	2	1232*	26⅞	29 1/16	53 1/16	66
.340	45	E	CMT	HG	CI	33	.859x2.75	4	1335	7 11/16	33	1040	Y	2.06x1.25	4	2.50x1.24	2.50x1.87	abce	18 mm	Zen	1¼	695	23¾	23 11/16	43⅜	67
.340	45	E	CMT	HG	CI	37	.859x2.87	4	1335	7⅞	35	1040	Y	2.12x1.37	4	2.50x1.31	2.50x1.87	abce	18 mm	ZC	1⅜	840	23¾	25 13/16	45⅝	68
.340	45	E	CMT	HG	Al	23	.859x2.75	4	1335	9	38	1040	Y	2.18x1.37	5	2.70x1.65	2.70x2.09	abce	18 mm	ZC(2)	1½	1074	23 11/16	28 1/16	54⅝	69
.562	45	E	CI	HG	CI	189	1.48x5.25	4	1035	14	194	1045	N	3.00x3.00	3	3.25x3.50	3.25x4.75	abceg	⅞-18	Zen	1¾	1800	30½	46	53¼	70
.562	45	E	CI	HG	Al	153	1.49x5.37	4	3135	16	244	4140	N	3.00x3.50	3	3.25x3.81	3.25x4.50	abceg	⅞-18	Zen	2	2300	31 3/16	49½	57 1/16	71
.562	45	E	CI	HG	Al	153	1.49x5.37	4	3135	16	244	4140	Y	3.00x3.50	3	3.25x3.81	3.25x4.50	abceg	⅞-18	Zen(2)	1¾	3200	29 1/16	51⅜	73 13/16	72
.562	45	E	CI	HG	Al	153	1.49x5.37	4	3135	16	244	4140	N	3.37x3.18	5	4.00x3.62	4.00x4.50	abceg	⅞-18	Zen(2)	2	4500	35 1/16	56 13/16	97 1/16	73
.562	45	E	NCI	HG	Al	165	2.00x5.75	5	3135	16	276	4140	N	4.00x5.00	7	4.30x3.75	4.50x5.50	abcdeg	18 mm	Zen(4)	2	11000	51	55	95	74
.562	45	E	NCI	HG	Al	176	2.00x5.75	5	3135	16	276	4140	N	4.00x5.00	7	4.50x3.75	4.50x5.50	abcdeg	18 mm	Zen(4)	2	11200	51	55	95	75
.562	45	E	NCI	HG	Al	165	2.00x5.75	5	3135	16	276	4140	N	4.00x5.00	5	4.50x3.75	4.50x5.50	abcdeg	18 mm	Zen(2)	2	8200	51	58	72¼	76
.562	45	E	NCI	HG	Al	176	2.00x5.75	5	3135	16	276	4140	N	4.00x5.00	5	4.50x3.75	4.50x5.50	abcdeg	18 mm	Zen(2)	2	8200	51	58	72¾	77

(For abbreviations see pages 66 and 67)

Line Number	Engine Make and Model	Designed for	Number of Cylinders, Bore and Stroke (In.)	Maximum Brake Hp. at Specified R.P.M. — With Bare Engine	Maximum Brake Hp. at Specified R.P.M. — With Standard Accessories	Piston Displacement (Cu. In.)	Compression Ratio	Maximum Torque at R.P.M. (Lb. Ft.) with or without Accessories	Cylinder Liners—Type	Crankcase—Upper Half Integral with Cylinders	Valves — Arrangement	Valves — Exhaust Head Material (S.A.E. No.)	Valves — Max. Head Diameter (In.) — Intake	Valves — Max. Head Diameter (In.) — Exhaust	Valves — Min. Port Diameter (In.) — Intake	Valves — Min. Port Diameter (In.) — Exhaust	Valves — Lift (In.) — Intake	Valves — Lift (In.) — Exhaust	Valves — Stem Diameter (In.) — Intake	Valves — Stem Diameter (In.) — Exhaust
1	Continental............Y-4069	C,Tr,Ind	4-2½x3½	28-3500	....	68.7	6.15	52-2000 (BE)	N	In	L	Sil	1.20	1.01	1.06	.875	.291	.292	.314	.313
2	Continental............Y-4091	C,Tr,Ind	4-2⅞x3½	37-3500	....	90.9	6.00	70-1800 (BE)	N	In	L	Sil	1.20	1.01	1.06	.875	.291	.292	.314	.313
3	Continental............Y-4112	C,Tr,Ind	4-3 3/16x3½	46-3400	....	111.7	6.00	87-1800 (BE)	N	In	L	Sil	1.20	1.01	1.06	.875	.291	.292	.314	.313
4	Continental............F-4124	C,T,Tr,Ind	4-3x4⅜	48-3400	....	123.7	6.00	94-1800 (BE)	N	In	L	Sil	1.51	1.32	1.37	1.18	.281	.280	.341	.339
5	Continental............F-4140	C,T,Tr,Ind	4-3 3/16x4⅜	51-3400	....	139.6	6.00	106-1600 (BE)	N	In	L	Sil	1.51	1.32	1.37	1.18	.281	.280	.341	.339
6	Continental............F-4162	C,T,Tr,Ind	4-3 7/16x4⅜	58-3200	....	162.4	5.75	124-1600 (BE)	N	In	L	Sil	1.51	1.32	1.37	1.18	.281	.280	.341	.339
7	Continental............F-6186	C,T,Tr,Ind	6-3x4⅜	64-3400	....	185.6	6.40	138-1400 (BE)	N	In	L	XCR	1.51	1.32	1.37	1.81	.281	.281	.341	.339
8	Continental............F-6209	C,T,Tr,Ind	6-3 3/16x4⅜	71-3200	....	209.5	5.75	155-1200 (BE)	N	In	L	Sil	1.51	1.32	1.37	1.18	.284	.284	.341	.339
9	Continental............F-6226	C,T,Tr,Ind	6-3 5/16x4⅜	76-3000	....	226.0	6.00	170-1200 (BE)	N	In	L	XCR	1.51	1.32	1.37	1.37	.281	.281	.341	.339
10	Continental............M-6271	T,B,Tr,Ind	6-3⅝x4⅜	92-3000	....	270.9	5.75	207-1200 (BE)	N	In	L	Sil	1.76	1.51	1.62	1.37	.354	.354	.404	.402
11	Continental............M-6290	T,B,Tr,Ind	6-3¾x4⅜	99-3000	....	289.9	5.70	225-1200 (BE)	N	In	L	Sil	1.76	1.51	1.62	1.37	.354	.354	.404	.402
12	Continental............M-6330	T,B,Tr,Ind	6-4x4⅜	107-2800	....	329.8	5.50	258-1000 (BE)	N	In	L	Sil	1.76	1.51	1.62	1.37	.354	.354	.404	.402
13	Continental............B-6371	T,B,Ind	6-4⅛x4⅝	109-2600	....	370.9	5.74	280-1000 (BE)	N	In	L	St	1.89	1.64	1.75	1.50	.354	.354	.435	.432
14	Continental............B-6405	T,B,Ind	6-4 5/16x4⅝	115-2600	....	405.3	5.74	314-1000 (BE)	N	In	L	St	1.89	1.64	1.75	1.50	.354	.354	.435	.432
15	Continental............22R	T,B,Ind	6-4½x5¼	141-2400	....	501.0	4.50	375-1000 (BE)	N	In	I	AUS	2.06	1.87	1.81	1.62	.420	.420	.435	.433
16	Continental............R6572	T,B,M,Ind	6-4¾x5⅜	175-2750	....	571.7	6.25	436-1250 (BE)	N	In	I	St	2.14	1.89	2.00	1.75	.500	.500	.500	.495
17	Continental............R6602	T,B,M,Ind	6-4⅞x5⅜	184-2600	....	601.9	6.00	460-1200 (BE)	N	In	I	St	2.14	1.89	2.00	1.75	.500	.500	.500	.495
18	Continental............B6427	T,B,M,Ind	6-4 5/16x4⅞	121-2500	....	427.2	6.60	332-900 (BE)	N	In	L	St	1.89	1.64	1.75	1.50	.354	.354	.435	.432
19	Continental............R6513	T,B,M,Ind	6-4½x5⅜	165-2600	....	512.9	5.90	400-1200 (BE)	N	In	I	St	2.14	1.89	2.00	1.75	.500	.500	.500	.495
20	Dodge............T-112	T	6-3¼x4⅜	95-3600	80-3400	217.8	6.80	172-1200 (BE)	N	In	L	Sil	1.53	1.41	1.40	1.28	.379	.379	.340	.340
21	Dodge............T-118,T-128	T	6-3 7/16x4¼	104-3000	90-3000	236.6	6.60	190-1600 (BE)	N	In	L	Sil	1.72	1.53	1.56	1.37	.379	.379	.340	.340
22	Dodge............T-120	T	6-3 7/16x4½	109-3000	95-3000	250.6	6.60	200-1500 (BE)	N	In	L	Sil	1.72	1.53	1.56	1.37	.379	.379	.340	.340
23	G. M. C............228	T	6-3 9/16x3 13/16	95-3200	85-3000	228.0	6.75	178-1000 (EA)	N	In	I	Sil	1.64	1.47	1.25	1.16	.323	.323	.343	.343
24	G. M. C............248	T, B	6-3 23/32x3 13/16	100-3100	89-3000	248.5	6.75	195-1000 (EA)	N	In	I	Sil	1.64	1.47	1.25	1.16	.323	.323	.343	.343
25	G. M. C............270	T, B	6-3 25/32x4	104-3000	95-3000	270.0	6.75	216-1000 (EA)	N	In	I	Sil	1.64	1.47	1.25	1.16	.323	.323	.343	.343
26	G. M. C............278	T	6-3⅝x4½	100-2800	86-2800	278.6	6.00	213-1000 (EA)	N	Se	I	CHS	1.81	1.56	1.44	1.37	.333	.333	.375	.375
27	G. M. C............308	T, B	6-3 13/16x4½	111-2800	87-2800	308.2	6.00	239-800 (EA)	N	Se	I	CHS	1.56	1.81	1.44	1.37	.333	.333	.375	.375
28	G. M. C............361	T	6-4⅛x4½	122-2800	106-2500	360.8	6.00	265-800 (EA)	N	Se	I	CHS	1.94	1.72	1.50	1.50	.406	.406	.375	.375
29	G. M. C............426	T	6-4¼x5	145-2600	127-2400	425.6	6.00	322-1000 (EA)	N	Se	I	CHS	1.94	1.72	1.50	1.50	.406	.406	.375	.375
30	G. M. C............451	T, B	6-4⅜x5	149-2600	130-2400	450.9	6.00	350-1000 (EA)	N	Se	I	CHS	1.94	1.72	1.50	1.50	.406	.406	.375	.375
31	G. M. C............477	T, B	6-4½x5	153-2600	135-2400	477.1	6.00	365-1000 (EA)	N	Se	I	CHS	1.94	1.72	1.50	1.50	.406	.406	.375	.375
32	G. M. C............529	B	6-4⅝x5¼	158-2500	144-2300	529.2	5.50	387-1000 (EA)	D	Se	I	CHS	2.12	1.94	1.66	1.62	.406	.406	.437	.437
33	G. M. C............707	B	6-5x6	175-2200	160-2100	706.8	5.15	555-1000 (EA)	D	Se	I	CHS	2.44	2.17	1.75	1.75	.413	.413	.437	.500
34	Gray............Light Four	M	4-2½x3½	....	16-1800	69.0	5.50	....	N	In	L	Sil	1.20	1.01	1.06	.875	.291	.292	.314	.312
35	Gray............Sea Scout	M	4-2⅞x3½	....	37-3000	91.0	6.50	....	N	In	L	Sil	1.20	1.01	1.06	.875	.291	.292	.314	.312
36	Gray............Phantom 4-45	M	4-2⅞x3½	....	45-3600	91.0	7.50	....	N	In	L	Sil	1.20	1.01	1.06	.875	.291	.292	.314	.312
37	Gray............Racing-91	M	4-2⅞x3½	....	65-5000	91.0	9.20	....	N	In	L	Sil	1.32	1.23	1.16	1.07	.284	.284	.314	.312
38	Gray............Racing-100	M	4-2 15/16x3⅝	....	75-5000	98.0	10.00	....	N	In	L	Sil	1.32	1.23	1.16	1.07	.284	.284	.314	.312
39	Gray............Four-22	M	4-3 3/16x3½	....	45-3000	112.0	6.50	....	N	In	L	Sil	1.20	1.01	1.06	.875	.291	.292	.314	.312
40	Gray............Four-40	M	4-3 3/16x4⅜	....	55-3000	140.0	5.50	....	N	In	L	Sil	1.51	1.32	1.37	1.18	.331	.331	.340	.338
41	Gray............Phantom 4-62	M	4-3 3/16x4⅜	....	62-3600	140.0	7.20	....	N	In	L	Sil	1.51	1.32	1.37	1.18	.331	.331	.340	.338
42	Gray............Four-52	M	4-3 7/16x4⅜	....	57-2600	162.0	6.00	....	N	In	L	Sil	1.51	1.32	1.37	1.18	.331	.331	.340	.338
43	Gray............Phantom 4-75	M	4-3 7/16x4⅜	....	75-3600	162.0	7.00	....	N	In	L	Sil	1.51	1.32	1.37	1.18	.331	.331	.340	.338
44	Gray............Phantom 4-86	M	4-3 7/16x4⅜	....	86-3600	162.0	8.00	....	N	In	L	Sil	1.51	1.32	1.37	1.18	.331	.331	.340	.338
45	Gray............Six-51	M	6-3¼x4	....	73-3200	199.0	6.00	....	N	In	L	Sil	1.51	1.32	1.37	1.18	.284	.284	.314	.312
46	Gray............Phantom 6-90	M	6-3¼x4⅜	....	90-3600	218.0	7.00	....	N	In	L	Sil	1.51	1.32	1.37	1.18	.284	.284	.314	.312
47	Gray............Phantom 6-103	M	6-3¼x4⅜	....	103-3600	218.0	7.00	....	N	In	L	Sil	1.51	1.32	1.37	1.18	.284	.284	.314	.312
48	Gray............Six-91	M	6-3 7/16x4⅜	....	100-3000	244.0	7.00	....	N	In	L	Sil	1.70	1.43	1.56	1.31	.375	.375	.372	.370
49	Gray............Phantom 6-125	M	6-3 7/16x4⅜	....	125-3600	244.0	7.00	....	N	In	L	Sil	1.70	1.43	1.56	1.31	.375	.375	.372	.370
50	Gray............Fireball 6-140	M	6-3 7/16x4⅜	....	140-4000	244.0	7.50	....	N	In	L	Sil	1.57	1.42	1.43	1.31	.311	.311	.339	.338
51	Gray............Fireball 6-150	M	6-3 7/16x4⅜	....	150-4000	244.0	7.50	....	N	In	L	Sil	1.57	1.42	1.43	1.31	.311	.311	.339	.338
52	Gray............Fireball 6-160	M	6-3 7/16x4⅜	....	160-4000	244.0	7.50	....	N	In	L	Sil	1.57	1.42	1.43	1.31	.311	.311	.339	.338
53	Gray............Racing Fireball	M	6-3.30x4⅜	....	180-5000	225.0	10.00	....	N	In	L	Sil	1.71	1.58	1.56	1.43	.360	.360	.340	.371
54	Gray............Six-121	M	6-4x4⅜	....	124-3200	330.0	6.50	....	N	In	L	Sil	1.76	1.51	1.62	1.37	.354	.354	.404	.402
55	Gray............Super Six	M	6-4x4⅜	....	145-3200	330.0	6.50	....	N	In	L	Sil	1.76	1.51	1.62	1.37	.354	.354	.404	.402
56	Gray............Six-105	M	6-4¼x4½	....	101-2400	383.0	5.50	....	N	In	L	Sil	2.06	1.87	1.81	1.62	.406	.406	.434	.432
57	Gray............Six-77	M	6-3 5/16x4⅜	....	84-3000	226.0	6.50	....	N	In	L	Sil	1.51	1.32	1.37	1.18	.284	.284	.341	.339
58	Hall-Scott............(H) 130	T, B, FA	6-4¼x5	130-3000	107-2800	425.6	4.96	288-1000 (BE)	W	In	I	2112	2.28	2.16	2.12	1.90	.421	.421	.435	.435
59	Hall-Scott............(H) 135	T, B, FA	6-4½x5	145-2800	122-2800	477.1	5.50	340-1000 (BE)	W	In	I	2112	2.28	2.16	2.12	1.90	.421	.421	.435	.435
60	Hall-Scott............(H) 180	T, B, FA	6-5x6	200-2200	170-2100	706.8	5.16	500-1400 (BE)	W	In	I	2112	2.62	2.37	2.37	2.00	.482	.482	.497	.528
61	Hall-Scott............(H) 190	T,B,FA,RC	6-5¼x6	240-2200	200-2000	779.3	5.00	570-1200 (BE)	W	In	I	2112	2.62	2.37	2.37	2.00	.482	.482	.497	.528
62	Hall-Scott............(H) 400	T	6-5¾x7	286-1800	260-1800	1090.0	5.70	865-1200 (BE)	N	Se	I	2112	2.87	2.75	2.62	2.50	.482	.482	.497	.528
63	Hall-Scott......Invader 186-87	M	6-5½x7	....	252-2100	997.8	5.09	....	N'	In	I	2112	2.87	2.87	2.62	2.62	.482	.482	.497	.528
64	Hall-Scott......Invader 168-69	M	6-5½x7	....	275-2100	997.8	5.09	....	N	In	I	2112	2.87	2.87	2.62	2.62	.482	.482	.497	.528
65	Hall-Scott....Defender 2286-87	M	12-5¾x7	....	605-2100	2181.0	7.00	....	N	Se	I	2112	2.87	2.75	2.62	2.50	.482	.482	.497	.528
66	Hall-Scott....Defender 2268-69	M	12-5¾x7	....	630-2100	2181.0	7.00	....	N	Se	I	2112	2.87	2.75	2.62	2.50	.492	.492	.497	.528
67	Hall-Scott....Defender ‡3368-69	M	12-5¾x7	....	900-2100	2181.0	6.00	....	N	Se	I	2112	2.87	2.75	2.62	2.50	.482	.482	.497	.528
68	Hercules............BXB	M, Tr, Ind	2-2⅞x3	10-2300	8-2300	39.0	6.00	28-1250 (BE)	N	In	L	AUS	1.30	1.05	1.12	.875	.200	.200	.248	.248
69	Hercules............NXB	M, Tr, Ind	2-3¼x4	16-2000	13-2000	66.3	5.50	46-1100 (BE)	N	In	L	AUS	1.48	1.35	1.25	1.12	.250	.250	.310	.310
70	Hercules............ZXB	T,Tr,M,Ind	4-2⅝x3	25-3800	21-3800	64.9	6.10	40-2000 (BE)	N	In	L	AUS	1.30	1.05	1.12	.875	.200	.200	.248	.248
71	Hercules............IXF-3	T,Tr,M,Ind	4-2¾x4	33.5-3200	28.5-3200	95.0	5.50	65-2000	N	In	L	AUS	1.48	1.35	1.25	1.12	.250	.250	.310	.310
72	Hercules......IXA-3, IXA-5	T,Tr,M,Ind	4-3x4	40-3200	34-3200	113.0	5.50	79-2000 (BE)	N	In	L	AUS	1.48	1.35	1.25	1.12	.250	.250	.310	.310
73	Hercules............IXK-3	T,Tr,M,Ind	4-3⅛x4	43-3200	37-3200	122.9	5.50	86-2000 (BE)	N	In	L	AUS	1.48	1.35	1.25	1.12	.250	.250	.310	.310
74	Hercules......IXB-3, IXB-5	T,Tr,M,Ind	4-3¼x4	47-3200	40-3200	133.0	5.20	92-2000 (BE)	N	In	L	AUS	1.48	1.35	1.25	1.12	.250	.250	.310	.310
75	Hercules............JXB	T,B,Tr,M,Ind	6-3⅝x4¼	84-3000	71.4-3000	263.0	5.40	195-1000	N	In	L	AUS	1.75	1.62	1.50	1.37	.356	.356	.373	.373
76	Hercules............JXC	T,B,Tr,M,Ind	6-3¾x4¼	87-3000	74-3000	282.0	5.90	215-1000 (BE)	N	In	L	AUS	1.75	1.62	1.50	1.37	.356	.356	.373	.373
77	Hercules............JXD	T,B,Tr,M,Ind	6-4x4¼	110-3000	93-3000	320.0	6.50	243-1200 (BE)	N	In	L	AUS	1.75	1.62	1.50	1.37	.356	.356	.373	.373
78	Hercules............WXLC	T,B,Tr,M,Ind	6-4x4¾	111-2800	94-2800	358.0	6.29	268-1100 (BE)	N	In	L	AUS	1.75	1.75	1.62	1.50	.388	.388	.373	.373
79	Hercules............WXLC-3	T,B,Tr,M,Ind	6-4¼x4¾	126-2600	107-2800	404.0	6.29	302-1000 (BE)	N	In	L	AUS	1.75	1.75	1.62	1.50	.388	.388	.373	.373
80	Hercules............RXC	T,B,Tr,M,Ind	6-4⅝x5¼	131-2400	111-2400	529.2	5.41	395-1000 (BE)	N	In	L	AUS	2.00	2.00	1.75	1.75	.398	.388	.373	.378
81	Hercules............RXLD	T,B,Tr,M,Ind	6-4¾x5¼	152-2400	129-2400	558.0	6.20	438-1000 (BE)	N	In	L	AUS	2.00	2.00	1.81	1.75	.398	.388	.373	.373
82	Hercules............HXB	T,B,Tr,M,Ind	6-5x6	160-2100	136-2100	707.0	5.75	502-900 (BE)	N	Se	L	AUS	2.43	2.31	2.12	2.00	.468	.468	.498	.498
83	Hercules............HXC	T,B,Tr,M,Ind	6-5¼x6	177-2100	150-2100	779.0	5.69	550-1000 (BE)	N	Se	L	AUS	2.43	2.31	2.12	2.00	.468	.468	.498	.498
84	Hercules............QXC-325	T,B,Tr,M,Ind	6-3⅜x4⅛	73-3500	62-3500	221.0	5.85	159-1000 (BE)	N	In	L	CNS	1.62	1.37	1.43	1.12	.281	.281	.310	.310
85	Hercules............QXD-325	T,B,Tr,M,Ind	6-3 7/16x4⅛	73-3000	62-3000	330.0	6.50	171-1100 (BE)	N	In	L	CNS	1.62	1.37	1.43	1.12	.281	.281	.310	.310
86	Hercules............HXD	T,B,Tr,M,Ind	6-5½x6	184-1800	156-1800	855.0	5.73	630-900 (BE)	N	Se	L	AUS	2.43	2.31	2.12	2.00	.468	.468	.498	.498
87	Hercules............HXE	T,B,Tr,M,Ind	6-5¾x6	200-1800	170-1800	935.0	5.50	695-900 (BE)	N	Se	L	AUS	2.43	2.31	2.12	2.00	.468	.468	.498	.498
88	International............U-2	Tr,Ind	4-3x4	24-1800	22-1800	113.1	5.23	78-1000 (EA)	W	In	I	CNS	1.34	1.21	1.18	1.06	.261	.261	.341	.341
89	International............U-4	Tr,Ind	4-3⅜x4¼	33-1800	31-1800	152.1	5.90	108-1250 (EA)	D	In	I	CNS	1.50	1.37	1.34	1.21	.343	.343	.341	.341
90	International............U-6	Tr,Ind	4-3⅞x5¼	42-1500	41-1500	247.7	5.65	162-900 (EA)	D	In	I	CNS	1.81	1.65	1.59	1.43	.438	.438	.371	.371

(For abbreviations see pages 66 and 67)

Engines—*Continued*

Valves: Seats: Angle (Deg.)	Valves: Seats: Inserts Used?	Valves: Seats: Insert Material (S.A.E. No.)	Camshaft Drive—Type	Pistons: Material	Pistons: Weight with Pins, Rings, Bushings (Oz.)	Pistons: Piston Pin—Diameter and Length (In.)	Number of Rings per Piston	Connecting Rods: Material	Connecting Rods: Center to Center Length (In.)	Connecting Rods: Weight with Bushing and Cap (Oz.)	Crankshaft: Material	Crankshaft: Counter Balance Used	Crankshaft: Crank-Pin Diameter and Length (In.)	Main Bearings: Number	Main Bearings: Diameter and Length (In.) Front	Main Bearings: Diameter and Length (In.) Rear	Oil Pressure to—	Spark Plug—Thread Size	Carburetor: Make	Carburetor: Size	Engine Weight without Carburetor or Ignition (Lb.)	Overall Dimensions (In.): Width	Overall Dimensions (In.): Height	Overall Dimensions (In.): Length	Line Number
(h)	N	.....	HG	CT	.....	.703x2.06	3	1030	5¾	.....	1045	N	1.50x1.18	3	1.75x1.37	1.75x1.78	abcet	18 mm	....	⅞	298	26	22 15/16	25½	1
(h)	N	.....	HG	CT	.....	.703x2.44	3	1030	5¾	.....	1045	N	1.50x1.18	3	1.75x1.37	1.75x1.78	abcet	18 mm	....	⅞	305	26	22 15/16	25½	2
(h)	N	.....	HG	CT	.....	.703x2.75	3	1030	5¾	.....	1045	N	1.50x1.18	3	1.75x1.28	1.75x1.65	abcet	18 mm	....	1	315	26	22 15/16	25½	3
(h)	E	WA	HG	CT	.....	.859x2.50	4	1030	7	.....	1045	N	1.93x1.31	3	2.25x1.18	2.25x1.89	abcet	18 mm	....	1¼	400	26	28 11/32	23 7/16	4
(h)	E	WA	HG	CT	.....	.859x2.68	4	1030	7	.....	1045	N	1.93x1.31	3	2.25x1.18	2.25x1.89	abcet	18 mm	....	1¼	405	26	26 11/32	29 7/16	5
(h)	E	WA	HG	CT	.....	.859x2.87	4	1030	7	.....	1045	N	1.93x1.31	3	2.25x1.18	2.25x1.89	abcet	18 mm	....	1¼	410	26	26 11/32	29 7/16	6
(h)	E	WA	Ch	CT	.....	.859x2.50	4	1030	7	.....	1045	Y	1.93x1.31	4	2.25x1.18	2.25x1.81	abcet	18 mm	....	1¼	481	26	27¼	36 11/32	7
(h)	E	WA	Ch	CT	.....	.859x2.62	4	1030	7	.....	1045	Y	1.93x1.31	4	2.25x1.21	2.25x1.81	abcet	18 mm	....	1¼	506	26	27¼	36 11/32	8
(h)	E	WA	Ch	CT	.....	.859x2.62	4	1030	7	.....	1045	Y	2.06x1.31	4	2.37x1.28	2.37x1.73	abcet	18 mm	....	1¼	512	26	27¼	36 11/32	9
(h)	E	WA	HG	CT	.....	1.10x3.06	4	1035	8⅜	.....	1045	Y	2.25x1.56	7	2.62x1.56	2.62x2.18	abcet	18 mm	....	1½	750	25¾	29½	42	10
(h)	E	WA	HG	CT	.....	1.10x3.18	4	1035	8⅜	.....	1045	Y	2.25x1.56	7	2.62x1.56	2.62x2.18	abcet	18 mm	....	1½	760	25¾	29½	42	11
(h)	E	WA	HG	CT	.....	1.10x3.43	4	1035	8⅜	.....	1045	Y	2.25x1.56	7	2.62x1.56	2.62x2.18	abcet	18 mm	....	1½	770	25¾	29½	42	12
(k)	E	HS	HG	Al	.....	1.25x3.43	5	1035	8⅜	.....	1045	Y	2.50x1.69	7	2.87x1.65	2.87x2.72	abcet	18 mm	....	1¾	855	26	29¼	43 11/32	13
(k)	E	HS	HG	Al	.....	1.25x3.43	5	1035	8⅜	.....	1045	Y	2.50x1.69	7	2.87x1.65	2.87x2.72	abcet	18 mm	....	1¾	870	26	29¼	43 11/32	14
30	E	HS	Ch	Al	.....	1.50x3.71	4	1035	10½	.....	4140	Y	2.75x1.81	7	2.75x1.75	2.75x2.81	abcefg	18 mm	....	2	1430	25¾	39⅝	48 11/32	15
(h)	E	Tun	HG	Al	.....	1.50x3.72	5	1035	10½	.....	1045	Y	3.00x1.94	7	3.25x1.75	3.25x2.75	abcegt	18 mm	....	2	1250	29	43 11/32	51 9/32	16
(h)	E	Tun	HG	Al	.....	1.50x3.72	5	1035	10½	.....	1045	Y	3.00x1.94	7	3.25x1.75	3.25x2.75	abcegt	18 mm	....	2	1250	29	43 11/32	51 9/32	17
(h)	E	Tun	HG	Al	.....	1.25x3.43	5	1035	8⅜	.....	1045	Y	2.50x1.69	7	2.87x1.65	2.87x2.71	abcegt	18 mm	....	1¾	885	26	29¼	43 11/32	18
(h)	E	Tun	HG	Al	.....	1.50x3.72	5	1035	10½	.....	1045	Y	3.00x1.94	7	3.25x1.75	3.25x2.75	abceg	18 mm	....	2	1250	29	43 11/32	51 9/32	19
45	E	SA	Ch	Al	.....	.85x2.75	4	MS	7 15/16	.....	CS	Y	2.06x1.00	4	2.50x1.17	2.50x1.59	abce	14 mm	Car	1½	500	23¾	35 1/16	35¼	20
45	E	SA	Ch	Al	.....	.85x2.87	4	MS	8	.....	CS	Y	2.12x1.09	4	2.50x1.15	2.50x1.59	abce	14 mm	Car	1½	560	23¾	35¼	39 13/16	21
45	E	SA	Ch	Al	.....	.85x2.87	4	MS	7⅞	.....	CS	Y	2.12x1.09	4	2.50x1.15	2.50x1.59	abce	14 mm	Car	1½	570	23¾	35¼	39 13/16	22
30	N	WR	HG	Al	33	.990x3.08	4	1040-A	7	33	1050	Y	2.31x1.44	4	2.69x1.44	2.78x1.73	abcdeg	14 mm	Zen	1⅜	.....	21 13/16	25 5/16	40¾	23
30	E	WR	HG	Al	34	.990x3.25	4	1040-A	7	33	1050	Y	2.31x1.44	4	2.69x1.44	2.78x1.73	abcdeg	14 mm	Zen	1⅜	.....	21 13/16	25 5/16	40¾	24
30	E	WR	HG	Al	34	.990x3.25	4	1040-A	7	33	1050	Y	2.31x1.44	4	2.69x1.44	2.78x1.73	abcdeg	14 mm	Zen	1⅜	.....	21 13/16	25 5/16	40¾	25
45	E	WR	HG	Al	37	1.00x3.18	4	1040-A	9¾	51	1050	Y	2.37x1.62	7	2.75x2.28	2.75x2.37	abcdeg	14 mm	Zen	1⅜	.....	25¼	31 23/32	45 1/32	26
45	E	WR	HG	Al	40	1.00x3.36	4	1040-A	9¾	51	1050	Y	2.37x1.62	7	2.75x2.28	2.75x2.37	abcdeg	14 mm	Zen	1⅜	.....	25¼	31 23/32	45 1/32	27
(h)	E	St	HG	Al	59	1.25x3.59	4	1040-A	10¾	73	1050	Y	2.62x1.75	7	3.00x2.37	3.00x2.50	abcdeg	14 mm	Zen	1½	.....	22½	35 3/16	47 11/16	28
(h)	E	St	HG	Al	60	1.25x3.71	4	1040-A	10¾	73	1050	Y	2.62x1.75	7	3.00x2.37	3.00x2.50	abcdeg	14 mm	Zen	1½	.....	22½	35 3/16	47 11/16	29
(h)	E	St	HG	Al	63	1.25x3.84	4	1040-A	10¾	73	1050	Y	2.62x1.75	7	3.00x2.37	3.00x2.50	abcdeg	14 mm	Zen	1¾	.....	22½	35 3/16	47 11/16	30
(h)	E	St	HG	Al	64	1.25x3.96	4	1040-A	10¾	.....	1050	Y	2.62x1.75	7	3.00x2.37	3.00x2.50	abcdeg	14 mm	Zen	1¾	.....	22½	35 3/16	47 11/16	31
30	E	St	HG	Al	66	1.25x4.06	4	1040-A	10½	82	1050	Y	2.62x2.06	7	3.50x2.56	3.50x2.62	abcdeg	14 mm	Zen	2	.....	27	47	50	32
30	E	St	HG	Al	77	1.37x4.47	5	4140-A	12⅛	77	4140	Y	2.75x2.27	7	3.00x2.41	3.00x3.09	abcdeg	18 mm	Str	2	.....	29½	50	62½	33
(h)	N	.....	HG	CI	16	.703x2.06	3	CS	5¾	17	1045	N	1.50x1.18	3	1.75x1.78	1.75x1.37	abce	14 mm	Zen	¾	330	16¼	17½	30	34
(h)	N	.....	HG	CI	21	.703x2.43	3	CS	5¾	17	1045	N	1.50x1.18	3	1.75x1.78	1.75x1.37	abce	14 mm	Zen	1	375	15	18⅝	30⅝	35
(h)	N	.....	HG	Al	16	.703x2.43	3	CS	5¾	17	1045	N	1.50x1.18	3	1.75x1.78	1.75x1.37	abce	14 mm	Zen	1⅜	340	17⅜	18½	30	36
(h)	N	.....	HG	Al	16	.703x2.43	3	CS	5¾	17	1045	N	1.50x1.18	3	1.75x1.78	1.75x1.37	abce	14 mm	Zen	1	265	21⅜	22 7/16	24½	37
(h)	N	.....	HG	Al	16	.703x2.43	3	CS	5¾	17	1045	N	1.50x1.18	3	1.75x1.78	1.75x1.37	abce	14 mm	Zen	1	260	21⅜	22 7/16	24½	38
(h)	N	.....	HG	CI	25	.709x2.68	3	CS	5¾	17	1045	N	1.50x1.18	3	1.75x1.66	1.75x1.28	abce	14 mm	Zen	1	410	15	18⅝	31⅝	39
(h)	N	.....	HG	Al	20	.859x2.68	4	CS	7	32	1045	N	1.93x1.31	3	2.25x1.89	2.25x1.18	abce	18 mm	Zen	1¼	510	18 7/16	23½	35⅛	40
(h)	N	.....	HG	Al	20	.859x2.68	4	CS	7	32	1045	N	1.93x1.31	3	2.25x1.89	2.25x1.18	abce	18 mm	Zen	1¼	435	20¼	21⅞	33	41
(h)	N	.....	HG	Al	24	.859x2.68	4	CS	7	32	1045	N	1.93x1.31	3	2.25x1.89	2.25x1.18	abce	18 mm	Zen	1¼	540	18 7/16	23½	35⅛	42
(h)	N	.....	HG	Al	24	.859x2.68	4	CS	7	32	1045	N	1.93x1.31	3	2.25x1.89	2.25x1.18	abce	18 mm	Zen	1¼	460	20¼	21⅞	33	43
(h)	N	.....	HG	Al	24	.859x2.68	4	CS	7	32	1045	N	1.93x1.31	3	2.25x1.89	2.25x1.18	abce	18 mm	Zen	1¼	465	22¾	27¾	33	44
(h)	N	.....	HG	CI	29	.859x2.68	4	CS	7	32	1045	Y	1.93x1.31	4	2.25x1.81	2.25x1.21	abce	18 mm	Zen	1¼	650	18½	23	41	45
(h)	N	.....	HG	Al	20	.859x2.68	4	CS	7	32	1045	Y	1.93x1.31	4	2.25x1.81	2.25x1.21	abce	18 mm	Zen	1½	625	23	22	39⅞	46
(h)	N	.....	HG	Al	20	.859x2.68	4	CS	7	32	1045	Y	1.93x1.31	4	2.25x1.81	2.25x1.21	abce	18 mm	Zen	1¼	630	23	22	39⅞	47
45	N	.....	HG	Al	28	.859x2.87	4	CS	8⅜	34	1045	Y	2.12x1.37	5	2.37x2.06	2.37x1.43	abce	18 mm	Zen	1¾	795	22	26⅛	43⅜	48
45	N	.....	HG	Al	28	.859x2.87	4	CS	8⅜	34	1045	Y	2.12x1.37	5	2.37x2.06	2.37x1.43	abce	18 mm	Zen	1¾	750	24½	25½	42⅞	49
(h)	N	.....	HG	Al	28	.859x2.87	4	CS	8⅜	34	1045	Y	2.12x1.37	4	2.37x2.06	2.37x1.43	abce	18 mm	Str	1½	730	22½	30	42¾	50
(h)	N	.....	HG	Al	28	.859x2.87	4	CS	8⅜	34	1045	Y	2.12x1.37	4	2.37x2.06	2.37x1.43	abce	18 mm	Str	1½	730	22½	30	42¾	51
(h)	N	.....	HG	Al	28	.859x2.87	4	CS	8⅜	34	1045	Y	2.12x1.37	4	2.37x2.06	2.37x1.43	abce	18 mm	Zen	1½	730	30¾	32½	42¾	52
45	N	.....	HG	Al	25	.874x2.92	4	CS	8⅜	32	1045	Y	2.12x1.37	4	2.39x1.91	2.39x1.50	abce	18 mm	Zen	1½	595	23¾	23	38⅞	53
(h)	N	.....	HG	Al	45	1.10x3.43	4	CS	8⅜	47	1045	Y	2.25x1.56	7	2.62x2.15	2.62x1.56	abce	18 mm	Str	1¾	1015	23 11/16	26	49⅝	54
(h)	N	.....	HG	Al	45	1.10x3.43	4	CS	8⅜	47	1045	Y	2.25x1.56	7	2.62x2.15	2.62x1.56	abce	18 mm	Str	1½	990	23 11/16	26	49	55
30	E	HS	HG	CI	74	1.25x3.43	4	CS	9	60	1045	Y	2.37x1.81	7	2.62x2.65	2.62x1.65	abce	18 mm	Str	1½	1250	22	29⅛	55⅝	56
(h)	N	.....	HG	CI	32	.859x2.81	4	.....	7	32	.....	Y	2.06x1.31	4	2.37x1.16	2.37x1.73	abce	18 mm	Zen	1½	665	18½	23	42	57
30	E	CA	Ch	Al	52	1.12x3.74	4	AS	11	104	4140	Y	2.62x2.00	7	3.00x1.50	3.00x2.25	abcefg	18 mm	Zen	1¾	1252*	54¾	18 7/16	52⅞	58
30	E	CA	Ch	Al	56	1.12x3.98	4	AS	11	104	4140	Y	2.62x2.00	7	3.00x1.50	3.00x2.25	abcefg	18 mm	Zen	1¾	1265*	54¾	18 7/16	52⅞	59
30	E	CA	Ch	Al	77	1.37x4.20	5	AS	11	119	4140	Y	2.75x2.45	7	3.00x2.18	3.25x2.56	abcefg	18 mm	Zen	2	1960*	53 1/16	20 11/16	69⅜	60
30	E	CA	HC	Al	104	1.37x4.43	5	AS	11	119	4140	Y	2.75x2.45	7	3.25x2.18	3.25x2.56	abcefg	18 mm	Zen(2)	1¾	2035*	53½	22¼	69⅜	61
(h)	E	4140°	HC	Al	120	1.37x4.93	6	3140	12	157	4140	Y	3.00x2.43	7	3.25x2.09	3.25x3.12	abceg	18 mm	Zen	2½	1950*	28	44⅝	60 9/16	62
30	N	.....	Ch	Al	108	1.37x4.68	5	AS	11	117	4140	Y	2.50x2.45	7	2.75x1.94	2.75x1.94	abcefg	18 mm	Zen(2)	2	3265*	25	47⅛	90½	63
30	N	.....	Ch	Al	108	1.37x4.68	5	AS	11	117	4140	Y	2.50x2.45	7	2.75x1.94	2.75x1.94	abcefgr	18 mm	Zen(2)	2	2200*	25	39⅝	74 3/16	64
30	E	CA	HC	Al	128	1.37x4.94	6	3140	12	237‡	4140	Y	3.00x2.43	7	3.25x2.09	3.25x2.09	abcefgr	18 mm	Zen(3)	2½	4560*	43¾	50¼	108 7/16	65
30	E	CA	HC	Al	128	1.37x4.94	6	3140	12	237‡	4140	Y	3.00x2.43	7	3.25x2.09	3.25x2.09	abcefgr	18 mm	Zen(3)	2½	3650*	45	42¾	88	66
30	E	CA	HC	Al	123	1.37x4.94	6	3140	12	237‡	4140	Y	3.00x2.43	7	3.25x2.09	3.25x2.09	abcefgr	18 mm	Zen(4)	2½	4105*	43¾	58¼	91 7/16	67
30	N	.....	HG	CI	17	.687x2.50	3	3140	5⅛	15	1045	Y	1.50x1.00	2	2.00x1.25	2.00x1.37	abe	14 mm	Op	⅝	131	14⅞	16¼	18 13/16	68
30	N	.....	HG	CI	29	.750x2.81	3	3140	6 9/16	21	1045	Y	1.75x1.12	2	2.00x1.56	2.00x1.62	abe	⅞-18	Op	Op	270	15¼	18½	18⅝	69
30	N	.....	HG	CI	19	.687x2.31	3	3140	5⅛	15	4140	N	1.50x1.00	3	2.00x1.31	2.00x1.37	abe	14 mm	Op	Op	179	14¾	16 9/16	21⅛	70
30	N	.....	HG	CI	19	.75x2.43	3	3140	6 9/16	21	1045	N	1.75x1.12	3	2.00x1.56	2.00x1.62	abe	⅞-18	Op	1¼	275	16⅝	18¾	24 3/16	71
30	N	.....	HG	CI	28	.750x2.56	3	3140	6 9/16	21	1045	N	1.75x1.12	3	2.00x1.56	2.00x1.62	abe	⅞-18	Op	Op	285	16⅝	18¾	24 3/16	72
30	N	.....	HG	CI	29	.750x2.56	3	3140	6 9/16	21	1045	N	1.75x1.12	3	2.00x1.56	2.00x1.62	abe	⅞-18	Op	Op	280	16⅝	18¾	24 3/16	73
30	N	.....	HG	CI	29	.750x2.81	3	3140	6 9/16	21	1045	N	1.75x1.12	3	2.00x1.56	2.00x1.62	abe	⅞-18	Op	Op	293	16⅝	18¾	24 3/16	74
45	N	.....	HG	Al	35	1.00x3.15	4	1035	8	37	CS‡	Op	2.00x1.50	7	2.50x1.31	2.50x2.12	abe	⅞-18	Op	1¼	560	17⅝	23½	37⅜	75
45	N	.....	HG	Al	37	1.00x3.37	4	1035	8	37	CS‡	Op	2.00x1.50	7	2.50x1.31	2.50x2.12	abe	⅞-18	Op	1¼	565	17⅝	23½	37⅜	76
45	N	.....	HG	Al	40	1.00x3.51	4	1035	8	37	CS‡	Op	2.00x1.50	7	2.50x1.31	2.50x2.12	abe	⅞-18	Op	1¾	570	17⅝	23½	37⅜	77
45	N	.....	HG	Al	47	1.12x3.56	4	3140	8⅞	50	CS‡	Y	2.25x1.50	7	2.62x1.75	2.75x2.75	abe	⅞-18	Op	1¾	811	21	27	41 11/16	78
45	N	.....	HG	Al	55	1.12x3.68	4	3140	8⅞	50	CS‡	Y	2.25x1.50	7	2.62x1.75	2.75x2.75	abe	⅞-18	Op	1¾	825	21	27	41 11/16	79
45	N	.....	HG	Al	62	1.25x4.06	5	3140	9⅜	81	1045	Op	2.62x2.00	7	3.00x1.93	3.00x2.93	abe	⅞-18	Op	1¾	1010	21 11/16	31 1/16	45 7/16	80
(h)	N	.....	HG	Al	69	1.25x4.10	5	CNM	9⅝	99	CS‡	Op	3.00x2.00	7	3.50x1.93	3.50x2.93	abe	⅞-18	Op	1¾	1195	22 11/16	30	44¾	81
30	E	.....	HG	Al	95	1.50x4.43	4	3140	12	143	1045‡	Op	3.00x2.25	7	3.50x2.37	3.50x3.50	abce	⅞-18	Op	2	1810	24½	40½	54½	82
30	E	.....	HG	Al	105	1.50x4.56	4	3140	12	143	1045‡	Op	3.00x2.25	7	3.50x2.37	3.50x3.50	abce	⅞-18	Op	2	1810	24½	40½	54½	83
30	N	.....	HG	Al	23.8	.875x2.90	4	1035	7	26	CS‡	N	2.00x1.25	7	2.50x1.31	2.50x1.93	abe	⅞-18	Op	1¼	480	17 7/16	20 7/16	33 7/16	84
30	N	.....	HG	Al	24.5	.875x2.90	4	1035	7	26	CS‡	N	2.00x1.25	7	2.50x1.31	2.50x1.93	abe	⅞-18	Op	1¼	485	17 7/16	20 1/16	33 7/16	85
30	E	.....	HG	Al	117	1.50x4.81	4	3140	12	143	1045‡	Op	3.00x2.25	7	3.50x2.37	3.50x3.50	abce	⅞-18	Op	2	1830	24½	40½	54½	86
30	E	.....	HG	Al	127	1.50x5.06	4	3140	12	143	1045‡	Op	3.00x2.25	7	3.50x2.37	3.50x3.50	ab ce	⅞-18	Op	2	1830	24½	40½	54½	87
45	N	.....	SB	CI	35	.919x2.50	4	1040	7¼	33	1045	N	1.75x1.19	3	2.12x1.37	2.12x1.84	abceg	18 mm	Zen	⅞	457*	16 1/16	33½	30 11/16	88
45	N	.....	SB	CI	53	1.11x2.78	4	1040	8	57	1045	N	2.25x1.23	3	2.50x1.49	2.50x1.49	abceg	18 mm	Own	1	639*	17½	32 11/16	33⅛	89
45	E	MA	SB	CI	82	1.31x3.25	4	1040	10	.....	1045	N	2.50x1.72	3	2.75x1.56	2.75x1.56	abceg	18 mm	Own	1¼	914*	19½	33¾	37	90

(For abbreviations see pages 66 and 67)

American Gasoline

Line Number	Engine Make and Model	Designed for	Number of Cylinders, Bore and Stroke (In.)	Maximum Brake Hp. at Specified R.P.M. — With Bare Engine	Maximum Brake Hp. at Specified R.P.M. — With Standard Accessories	Piston Displacement (Cu. In.)	Compression Ratio	Maximum Torque at R.P.M. (Lb. Ft.) with or without Accessories	Cylinder Liners—Type	Crankcase—Upper Half Integral with Cylinders	Valves — Arrangement	Exhaust Head Material (S.A.E. No.)	Max. Head Diameter (In.) — Intake	Max. Head Diameter (In.) — Exhaust	Min. Port Diameter (In.) — Intake	Min. Port Diameter (In.) — Exhaust	Lift (In.) — Intake	Lift (In.) — Exhaust	Stem Diameter (In.) — Intake	Stem Diameter (In.) — Exhaust
1	International.....U-9	Tr,Ind	4-4.4x5½	55.5-1500	54.5-1500	334.5	5.40	227-1000 (EA)	D	In	I	CNS	2.09	1.91	1.87	1.69	.469	.469	.402	.402
2	International.....GRD-233	T	6-3 5/16x4½	93-3400	80-3400	232.6	6.30	176-800 (EA)	In	In	L	Sil	1.68	1.46	1.50	1.34	.320	.320	.372	.371
3	International.....BLD-269	T	6-3 9/16x4½	100-3000	89-2800	269.1	6.30	216-1000 (EA)	D	In	I	Sil	1.65	1.46	1.50	1.31	.332	.332	.342	.342
4	International.....RED-361	T	6-4⅛x4½	126-3000	112-2800	361.0	6.30	278-1000 (EA)	D	In	I	XCR	2.25	1.54	2.00	1.43	.449	.449	.434	.434
5	Kermath.....ZX	M	4-2⅝x3	.....	25-3400	65.0	6.00	40-1700 (EA)	N	In	L	Sil	1.25	1.12	1.12	.875	.250	.250	.310	.310
6	Kermath.....IXH	M	4-3¼x4	.....	60-3600	134.0	5.50	97-2200 (EA)	N	In	L	Sil	1.48	1.35	1.25	1.12	.250	.250	.310	.310
7	Kermath.....KWF	M	4-3⅛x4⅜	.....	40-2700	134.0	6.48	106-2200 (EA)	N	In	L	.....	1.53	1.46	1.34	1.23	.359	.359	.373	.373
8	Kermath.....KWHS	M	4-3⅛x4⅜	.....	61-3600	134.0	6.48	106-2200 (EA)	N	In	L	.....	1.53	1.46	1.34	1.28	.359	.359	.373	.373
9	Kermath.....KWSS	M	4-3⅛x4⅜	.....	68-3800	134.0	6.48	106-2200 (EA)	N	In	L	.....	1.53	1.46	1.34	1.28	.359	.359	.373	.373
10	Kermath.....P-841	M	6-3¼x3¾	.....	110-3600	187.0	7.00	.....	N	In	L	Sil	1.47	1.34	1.31	1.18	.296	.296	.312	.312
11	Kermath.....QXC	M	6-3⅜x4⅛	.....	95-3600	221.0	6.50	.....	N	In	L	Sil	1.87	1.87	1.81	1.81	.281	.281	.310	.310
12	Kermath.....P-840	M	6-3 9/16x4	.....	103-3600	239.0	7.20	.....	N	In	L	Sil	1.59	1.47	1.37	1.31	.296	.296	.312	.312
13	Kermath.....JXD	M	6-4x4¼	.....	122-3000	320.0	6.90	235-2000 (EA)	N	In	L	CNS	1.84	1.62	1.62	1.37	.376	.376	.373	.373
14	Kermath.....WXC	M	6-4¼x4½	.....	115-2600	383.0	5.80	265-1000 (EA)	N	In	L	Sil	1.87	1.75	1.62	1.50	.356	.356	.373	.373
15	Kermath.....WXL	M	6-4¼x4¾	.....	155-3000	404.0	6.50	.....	N	In	L	CNS	2.06	1.87	1.81	1.62	.500	.500	.373	.373
16	Kermath.....D	M	6-4⅜x5¾	.....	150-2500	520.0	5.70	350-1000 (EA)	N	Se	L	CNS	2.50	2.25	2.28	2.00	.437	.375	.437	.375
17	Kermath.....L	M	6-5x5¾	.....	157-2000	678.0	5.30	482-1000 (EA)	N	Se	L	CNS	2.56	2.37	2.37	2.12	.375	.375	.437	.437
18	Kermath.....LA	M	6-5x5¾	.....	200-2400	678.0	5.70	480-1000 (EA)	N	Se	L	CNS	2.62	2.37	2.40	2.00	.437	.375	.437	.437
19	Kermath.....R	M	6-5x5¾	.....	225-2400	678.0	5.70	540-1700 (EA)	N	Se	I	CNS	1.93	1.93	1.76	1.76	.375	.375	.437	.375
20	Kermath.....VF	M	8-3 1/16x3¾	.....	85-3800	221.0	6.30	150-2000 (EA)	....	In	L	Sil	1.53	1.53	.....	.....	.292	.292	.310	.310
21	Kermath.....VM	M	8-3 3/16x3¾	.....	95-3600	239.0	6.15	170-2100 (EA)	....	In	L	CNS	1.53	1.53	.....	.....	.292	.292	.311	.311
22	Kermath.....P-836	M	8-3¼x3½	.....	100-3600	232.0	7.00	175-1600 (EA)	N	In	L	Sil	1.37	1.34	1.25	1.19	.328	.328	.312	.312
23	Kermath.....VZ	M	12-2⅞x3¾	.....	120-3500	292.0	.....	.....	....	In	L	CNS	1.53	1.53	.....	.....	.292	.292	.311	.311
24	Kermath.....V	M	12-5x6	.....	500-2400	1414.0	5.70	1070-1400 (EA)	N	Se	I	CNS	1.93	1.93	1.76	1.76	.375	.375	.437	.437
25	Lathrop.....Standard	M	2-5 3/16x6½	.....	16-600	274.7	.....	140-525 (EA)	N	Se	T	CNS	2.25	2.25	2.00	2.00	.375	.375	.437	.437
26	Lathrop.....Standard	M	2-5½x6½	.....	20-700	308.8	.....	163-525 (EA)	N	Se	T	CNS	2.25	2.25	2.00	2.00	.375	.375	.437	.437
27	Lathrop.....Standard	M	3-5 3/16x6½	.....	27-700	412.1	.....	206-600 (EA)	N	Se	T	CNS	2.25	2.25	2.00	2.00	.375	.375	.437	.437
28	Lathrop.....Standard	M	3-5½x6½	.....	34-800	463.2	.....	237-700 (EA)	N	Se	T	CNS	2.25	2.25	2.00	2.00	.375	.375	.437	.437
29	Lathrop.....LH	M	4-3¼x4	.....	32-2200	133.0	.....	92-2000 (EA)	N	In	L	CNS	.....	.....	1.25	1.12	.312	.312	.312	.312
30	Lathrop.....Standard	M	4-5 3/16x6½	.....	29-700	549.5	.....	233-500 (EA)	N	Se	T	CNS	2.25	2.25	2.00	2.00	.375	.375	.437	.437
31	Lathrop.....Standard	M	4-5½x6½	.....	49-800	617.7	.....	342-600 (EA)	N	Se	T	CNS	2.25	2.25	2.00	2.00	.375	.375	.437	.437
32	Lathrop.....Engineers	M	4-5½x7	.....	64-1000	665.2	.....	373-650 (EA)	N	Se	L	CNS	2.68	2.50	2.31	2.12	.375	.375	.500	.500
33	Lathrop.....Engineers	M	4-6x7	.....	76-1000	791.6	.....	461-700 (EA)	N	Se	L	CNS	2.68	2.50	2.31	2.12	.375	.375	.500	.500
34	Lathrop.....LH	M	6-3¾x4¼	.....	62-2200	282.0	.....	173-550 (EA)	N	In	L	CNS	.....	.....	1.50	1.37	.312	.312	.375	.375
35	Lathrop.....LH-D6	M	6-4x4¼	.....	107-2500	320.0	.....	226-2500 (EA)	N	In	L	CNS	1.75	1.62	1.50	1.37	.356	.356	.375	.375
36	Lathrop.....Mystic	M	6-4½x5½	.....	96-1600	524.8	.....	321-1350 (EA)	N	Se	L	CNS	2.25	2.25	2.00	2.00	.375	.375	.437	.437
37	Lathrop.....Mystic	M	6-4¾x5½	.....	106-1600	584.7	.....	379-900 (EA)	N	Se	L	CNS	2.25	2.25	2.00	2.00	.375	.375	.437	.437
38	Lathrop.....Standard	M	6-5½x6½	.....	73-750	926.5	.....	515-675 (EA)	N	Se	T	CNS	2.25	2.25	2.00	2.00	.375	.375	.437	.437
39	Lathrop.....Standard	M	6-5½x6½	.....	103-1000	926.5	.....	550-825 (EA)	N	Se	T	CNS	2.25	2.25	2.00	2.00	.500	.500	.437	.437
40	Lathrop.....Mystic	M	6-5½x6½	.....	155-1500	926.5	.....	561-1200 (EA)	N	Se	L	CNS	2.68	2.68	2.31	2.31	.437	.437	.500	.500
41	Lathrop.....Mystic	M	6-5¾x6½	.....	179-1600	1012.8	.....	640-1100 (EA)	N	Se	L	CNS	2.68	2.68	2.31	2.31	.437	.437	.500	.500
42	Le Roi.....X	Ind	4-2⅞x3½	.....	16-1800	90.8	4.75	50.5-1200 (EA)	N	In	L	Sil	1.43	1.43	1.06	1.06	.187	.187	.312	.312
43	Le Roi.....D140	Ind	4-3½x3⅝	.....	33-2300	140.0	5.85	94.5-1200 (EA)	W	In	I	CNS	1.37	1.28	1.18	1.18	.311	.311	.342	.342
44	Le Roi.....D176	Ind	4-3¾x4	.....	38-1800	176.0	5.40	122-1200 (EA)	W	In	I	CNS	1.68	1.50	1.37	1.25	.373	.373	.372	.372
45	Le Roi.....D201	Ind	4-4x4	.....	44-1800	201.0	4.87	140-1200 (EA)	W	In	I	CNS	1.68	1.50	1.37	1.25	.373	.373	.372	.372
46	Le Roi.....D226	Ind	4-4x4½	.....	51-1800	226.0	4.71	167-1200 (EA)	W	In	I	CNS	1.68	1.50	1.37	1.25	.373	.373	.372	.372
47	Le Roi.....D318	Ind	4-4½x5	.....	46-1200	318.0	4.60	204-900 (EA)	W	In	I	CNS	1.87	1.75	1.75	1.62	.470	.470	.433	.433
48	Le Roi.....D382	Ind	4-4½x6	.....	57-1200	382.0	4.60	257-900 (EA)	W	In	I	.....	1.87	1.75	1.75	1.62	.470	.470	.433	.433
49	Le Roi.....D471	Ind	4-5x6	.....	70-1200	471.0	4.50	320-900 (EA)	W	In	I	CNS	1.87	1.75	1.75	1.62	.470	.470	.433	.433
50	Le Roi.....RXI	Ind	4-6¾x7	.....	140-1200	1002.0	4.50	690-650 (EA)	N	Se	I	Sil	2.81	2.81	2.12	2.50	.590	.590	.624	.624
51	Le Roi.....RXIS	Ind	6-6¾x7	.....	208-1200	1503.0	4.50	1035-650 (EA)	N	Se	I	Sil	2.81	2.81	2.12	2.50	.590	.590	.624	.624
52	Le Roi.....RXIV	Ind	8-6¾x7	.....	278-1200	2004.0	4.50	1380-650 (EA)	N	Se	I	Sil	2.81	2.81	2.12	2.50	.590	.590	.624	.624
53	Le Roi.....RXISV	Ind	12-6¾x7	.....	416-1200	3006.0	.....	2075-650 (EA)	N	Se	I	Sil	2.81	2.81	2.12	2.50	.590	.590	.624	.624
54	M-M Twin City (8).....165-4	Ind	4-3⅝x4	26-1400	25-1400	165.1	5.75	107-1000 (BE)	N	Se	HH	.....	1.46	1.46	1.25	1.25	.354	.354	.341	.341
55	M-M Twin City.....185-4	Ind	4-3⅝x4½	33-1500	32-1500	185.7	5.75	124-1100 (BE)	N	Se	HH	.....	1.46	1.46	1.25	1.25	.354	.354	.341	.341
56	M-M Twin City.....283-4	Ind	4-4½x5	51-1300	49-1100	283.7	5.40	212-1000 (BE)	N	Se	I	.....	1.71	1.59	1.50	1.37	.488	.488	.434	.434
57	M-M Twin City.....403-4	Ind	4-4⅝x6	65-1100	63-1100	403.2	5.25	315-900 (BE)	N	Se	I	.....	1.84	1.71	1.62	1.50	.488	.488	.434	.434
58	M-M Twin City.....ME	Ind	4-8x9	153-650	.....	1810.0	4.70	1253-500 (BE)	N	Se	I	.....	3.34	3.34	3.00	3.00	.700	.700	.683	.683
59	M-M Twin City.....425.6	Ind	6-4¼x5	76-1300	73-1300	425.5	5.40	302-1100 (BE)	N	Se	I	.....	1.71	1.59	1.50	1.37	.488	.488	.434	.434
60	M-M Twin City.....206.4	Ind	6-4⅝x6	94-1100	88-1100	605.0	5.25	458-800 (BE)	N	Se	I	.....	1.84	1.71	1.62	1.50	.488	.488	.434	.434
61	M-M Twin City.....NE	Ind	6-8x9	222-650	.....	2714.0	4.70	1880-450 (BE)	N	Se	I	.....	3.34	3.34	3.00	3.00	.700	.700	.683	.683
62	M-M Twin City.....605.6	Ind	4-3⅝x5	40-1500	38-1500	206.5	6.15	150-1100 (BE)	N	Se	HH	.....	1.46	1.46	1.25	1.25	.354	.354	.341	.341
63	Oliver.....60HC	Tr	4-3 5/16x3½	.....	21.2-1500	120.6	6.00	75-1000 (EA)	W	In	I	Sil	1.18	1.12	1.06	1.00	.281	.281	.375	.375
64	Oliver.....80HC	Tr	4-4¼x5¼	.....	46.1-1200	298.0	5.25	190-850 (EA)	W	In	I	Sil	2.00	1.75	1.75	1.50	.406	.406	.375	.375
65	Oliver.....80KD	Tr	4-4½x5¼	.....	45-1200	334.0	4.23	190-850 (EA)	W	In	I	Sil	2.00	1.75	1.75	1.50	.406	.406	.375	.375
66	Oliver.....90	Tr	4-4¾x6¼	.....	56.7-1125	443.0	4.10	250-850 (EA)	W	In	I	Sil	2.31	2.31	2.00	2.00	.437	.437	.437	.437
67	Oliver.....99	Tr	4-4¾x6¼	.....	65-1125	443.0	5.04	295-850 (EA)	W	In	I	Sil	2.31	2.00	2.00	1.75	.437	.437	.437	.437
68	Oliver.....70KD	Tr	6-3⅛x4⅜	.....	31.3-1500	201.3	4.50	105-1150 (EA)	W	In	I	Sil	1.54	1.20	1.37	1.06	.390	.390	.375	.375
69	Oliver.....70HC	Tr	6-3⅛x4⅜	.....	36.3-1500	201.3	6.50	105-1150 (EA)	W	In	I	Sil	1.54	1.20	1.37	1.06	.390	.390	.375	.375
70	Oliver.....60KD	Tr	4-3 5/16x3½	.....	18-1500	120.6	5.00	63-1000 (EA)	W	In	I	Sil	1.18	1.12	1.06	1.00	.281	.281	.375	.375
71	Reo.....GC-245	T	6-3½x4¼	89-3100	.....	245.0	6.20	191-1000 (BE)	N	In	L	Sil	1.78	1.62	.....	.....	.324	.324	.373	.373
72	Reo.....GC-288	T	6-3½x5	94-3000	.....	288.0	6.20	221-1200 (BE)	N	In	L	Sil	1.78	1.62	.....	.....	.324	.324	.373	.373
73	Reo.....GC-310	T,B	6-3⅝x5	101-3000	.....	310.0	6.20	241-900 (BE)	N	In	L	Sil	1.78	1.62	.....	.....	.324	.324	.373	.373
74	Scripps.....34	M	4-3¼x4	.....	32-2200	134.0	5.20	92-2000 (BE)	....	In	L	Sil	1.48	1.35	1.25	1.12	.250	.250	.310	.310
75	Scripps.....36	M	4-3¼x4	.....	50-3200	134.0	.....	.....	....	In	L	Sil	1.48	1.35	1.25	1.12	.250	.250	.310	.310
76	Scripps.....F4	M	4-3¾x5	.....	81-3000	220.0	6.10	.....	....	In	L	Sil	1.93	1.93	.....	.....	.406	.406	.375	.375
77	Scripps.....96A-97A	M	6-3 7/16x4⅛	.....	95-3000	221.0	5.85	187-1200 (BE)	....	In	L	Sil	1.60	1.39	1.43	1.12	.281	.231	.312	.312
78	Scripps.....F6	M	6-3¾x5	.....	120-3000	331.0	6.10	.....	....	In	L	Sil	1.93	1.93	.....	.....	.406	.406	.375	.375
79	Scripps.....104A-105A	M	6-4x4¼	.....	110-3000	320.0	5.63	239-1700 (BE)	....	In	L	Sil	1.75	1.62	1.50	1.37	.322	.322	.373	.373
80	Scripps.....152-153	M	6-4¼x5¼	.....	169-3000	447.0	6.20	.....	....	Se	L	Sil	2.25	2.25	.....	.....	.375	.375	.437	.437
81	Scripps.....154, 5, 6, 7	M	6-4¼x5¼	.....	155-3000	447.0	6.20	.....	....	Se	L	Sil	2.25	2.25	.....	.....	.375	.375	.437	.437
82	Scripps.....162-163	M	6-4½x5¾	.....	166-2400	549.0	5.75	.....	....	Se	L	Sil	2.37	2.28	.....	.....	.405	.375	.437	.437
83	Scripps.....166-167	M	6-4½x5¾	.....	145-2200	549.0	5.20	.....	....	Se	L	Sil	2.56	2.28	.....	.....	.405	.375	.437	.437
84	Scripps.....168-169	M	6-4½x5¾	.....	175-2400	549.0	5.75	.....	....	Se	L	Sil	2.37	2.28	.....	.....	.405	.375	.437	.437
85	Scripps.....172A-173A	M	6-4¾x5¾	.....	200-2400	611.0	5.20	.....	....	Se	L	Sil	2.37	2.28	.....	.....	.405	.375	.437	.437
86	Scripps.....176A-177A	M	6-4¾x5¾	.....	155-2200	611.0	5.20	.....	....	Se	L	Sil	2.56	2.28	.....	.....	.405	.375	.437	.437
87	Scripps.....178-179	M	6-4¾x5¾	.....	200-2400	611.0	5.75	.....	....	Se	L	Sil	2.37	2.28	.....	.....	.405	.375	.437	.437

(For abbreviations see pages 66 and 67)

Engines—*Continued*

Stem Diameter (In.) Intake	Stem Diameter (In.) Exhaust	VALVES Seats Angle (Deg.)	Inserts Used?	Insert Material (S.A.E. No.)	Camshaft Drive—Type	PISTONS Material	Weight with Pins, Rings, Bushings (Oz.)	Piston Pin—Diameter and Length (In.)	Number of Rings per Piston	CONNECTING RODS Material	Center to Center Length (In.)	Weight with Bushing and Cap (Oz.)	CRANKSHAFT Material	Counter Balance Used	Crank-Pin Diameter and Length (In.)	MAIN BEARINGS Number	Diameter and Length (In.) Front	Diameter and Length (In.) Rear	Oil Pressure to—	Spark Plug—Thread Size	CARBURETOR Make	Size	Engine Weight without Carburetor or Ignition (Lb.)	OVERALL DIMENSIONS (In.) Width	Height	Length	Line Number
02	.402	45	E	MA	SG	CI	111	1.50x3.71	4	1040	11	123	1045‡	Y	2.99x1.97	3	3.25x1.82	3.25x1.82	abcdeg	⅞-18	Own	1⅜	1253*	23 13/16	42 5/16	40¼	1
72	.371	45	E	MA	Ch	CI	38	.978x2.88	4	1040	8¼	34	1045	Y	2.00x1.31	4	2.62x1.54	2.62x2.09	abcde	18 mm	Zen	1¼	624*	23¾	29 5/16	38 7/16	2
42	.342	45	E	MA	SB	Al	31	.919x2.95	4	3140	8 9/16	43	4140	Y	2.12x1.68	4	2.70x1.12	2.70x1.23	abcdeg	14 mm	Zen	1¼	874*	22⅜	31⅜	47⅜	3
34	.434	(n)	E	MI	HG	Al	47	1.11x3.55	4	3140	9	61	1045	Y	2.75x1.68	7	3.25x1.34	3.25x1.84	abcdeg	14 mm	Zen	1½	956	27¼	35⅜	47⅜	4
10	.310	30	N	......	HG	CI	19	.687x2.18	3	CS	5⅛	15	CS	N	1.50x1.00	3	2.00x1.37	2.00x1.31	abcr	14 mm	Str	¾	300*	18 11/16	17⅝	29 3/16	5
10	.310	30	N	......	HG	Al	20	.750x2.87	4	3140	6 9/16	20	CS	N	1.75x1.12	3	2.00x1.62	2.00x1.58	abcr	⅞-18	Str	1¼	405*	23⅛	21 15/16	34 3/16	6
73	.373	45	N	......	Ch	Al	12	.812x2.78	3	MS	9 3/16	34	1040	Y	1.93x1.31	3	2.33x1.75	2.33x1.92	abcr	14 mm	Str	1¼	495	21¼	24½	36	7
73	.373	45	N	......	Ch	Al	12	.812x2.78	3	MS	9 3/16	34	1040	Y	1.93x1.31	3	2.33x1.75	2.33x1.92	abcr	14 mm	Str	1¼	495	21¼	24½	36	8
73	.373	45	N	......	Ch	Al	12	.812x2.78	3	MS	9 3/16	34	1040	Y	1.93x1.31	3	2.33x1.75	2.33x1.92	abcr	14 mm	Str	1¼	495	21¼	24½	36	9
2	.312	(h)	N	......	Ch	CNI	32	.937x2.87	3	DFS	7 9/16	32	DFS	Y	2.00x1.06	5	2.50x1.87	2.37x1.25	abcder	14 mm	Str	1½	860*	24	23 3/16	52½	10
0	.310	30	N	......	HG	Al	24	.875x2.79	4	CS	7	26	CS	N	2.00x1.25	7	2.50x1.93	2.50x1.87	abcr	⅞-18	Str	1½	620*	24	24⅛	42 5/16	11
2	.312	(h)	N	......	Ch	CI	......	......	3	DFS	7 9/16	37	DFS	Y	2.12x1.28	4	2.62x1.56	2.50x1.25	abcder	14 mm	Str	1½	790*	24	23 3/16	47⅞	12
3	.373	30	N	......	HG	Al	40	1.00x3.51	4	CS	8	38	CS	N	2.00x1.50	7	2.50x2.12	2.50x1.37	abcr	⅞-18	Str	1¾	925*	21 13/16	27¾	52⅜	13
3	.373	45	N	......	HG	Al	.....	1.12x3.68	4	CS	9⅛	51	CS	N	2.25x1.50	7	2.62x1.75	2.62x2.75	abcr	14 mm	Str	1¾	1125*	24¼	29⅝	56 3/16	14
3	.373	30	N	......	HG	Al	.....	1.12x3.62	4	CS	9	51	CS	Y	2.25x1.12	7	2.68x2.75	2.68x1.75	abcr	14 mm	Str	2	1125*	24¼	29⅝	56 3/16	15
7	.375	(h)	E	HS	HG	Als	62	1.25x3.62	4	DFS	11	80	CS	N	2.25x2.23	7	2.50x3.91	2.50x2.56	abcder	14 mm	Str	2	1390*	26¾	33¼	69⅞	16
7	.437	45	N	......	HG	Als	82	1.25x4.50	4	DFS	11	80	CS	N	2.25x2.23	7	2.50x3.91	2.50x2.62	abcder	18 mm	Str	2	1570*	29 13/16	34 1/16	69⅞	17
7	.437	45	N	......	HG	Als	82	1.25x4.50	4	DFS	11	80	CS	N	2.25x2.23	7	2.50x3.91	2.50x2.62	abcder	14 mm	Str(2)	1¾	1570*	26⅛	34 1/16	69⅞	18
5	.375	45	N	......	SB	Als	82	1.25x4.50	4	DFS	11	80	DFS	N	2.25x2.23	7	2.50x3.91	2.50x2.62	abcder	18 mm	Str(2)	1¾	1500*	30½	39¾	69¾	19
0	.310	45	Bo	TA	HG	CAS	12	.750x2.85	3	AS	7	16	CAS	Y	2.00x1.94	3	2.00x1.81	2.00x2.25	abcr	⅞-18	Ford	....	730	29 1/16	31 7/16	43 15/16	20
	.311	45	Bo	TA	HG	CAS	17	.750x2.84	3	AS	7	17	CAS	Y	2.14x1.75	3	2.50x1.72	2.50x2.25	abce	14 mm	Ford	....	730	29 1/16	31 7/16	43 15/16	21
2	.312	(h)	......	......	Ch	CI	32	.937x2.87	3	DFS	7 9/16	32	DFS	Y	2.00x1.56	5	2.37x2.25	2.24x1.31	abcder	14 mm	Str	1½	860*	24	23 3/16	52½	22
	.311	45	Bo	TA	HG	CAS	11	.750x2.48	3	DFS	......	22	CAS	Y	2.12x1.57	4	2.40x1.83	2.40x2.54	abce	14 mm	Ford	....	800	24 11/16	32	51½	23
	.437	45	N	......	SB	Als	82	1.25x4.50	4	CNS	11	184	CNS	Y	2.75x2.25	7	3.00x3.84	3.00x2.25	abcder	18 mm	Str(4)	2	.2700*	42½	43 9/16	75 15/16	24
	.437	45	......	......	HG	CI	160	1.37x4.62	4	AS	12¼	96	CNS	N	1.87x2.75	3	2.25x5.00	2.25x4.00	abe	⅞-18	Zen	1¼	975	23½	22	55½	25
	.437	45	......	......	HG	CI	179	1.37x5.00	4	AS	12¼	96	CNS	N	1.87x2.75	3	2.25x5.00	2.25x4.00	abe	⅞-18	Zen	1¼	1000	23½	22	55½	26
	.437	45	......	......	HG	CI	160	1.37x4.62	4	AS	12¼	96	CNS	N	1.87x2.75	4	2.25x5.00	2.25x4.00	abe	⅞-18	Zen	1½	1400	25	22¼	60½	27
	.437	45	......	......	HG	CI	179	1.37x5.00	4	AS	12¼	96	CNS	N	1.87x2.75	4	2.25x5.00	2.25x4.00	abe	⅞-18	Zen	1½	1450	25	22¼	60½	28
	.312	30	......	......	HG	Al	.....	.750x2.81	3	AS	6 9/16	.....	CNS	N	1.87x2.75	4	......	......	abe	⅞-18	Zen	1	440	17½	14⅜	40½	29
	.437	45	......	......	HG	CI	160	1.37x4.62	4	AS	12¼	96	CNS	N	2.00x1.50	3	2.00x2.18	2.00x2.62	abe	⅞-18	Zen	1½	1700	25¾	22¼	68½	30
	.437	45	......	......	HG	CI	179	1.37x5.00	4	AS	12¼	96	CNS	N	1.87x2.75	5	2.25x5.00	2.25x4.00	abe	⅞-18	Zen	1½	1750	25¾	22¼	68½	31
	.500	45	E	Spec	HG	CI	186	1.50x5.00	4	AS	13¼	172	CNS	N	1.87x2.75	5	2.25x5.00	2.25x4.00	......	⅞-18	Zen	....	2100	29¼	24	74¼	32
	.500	45	E	Spec	HG	CI	204	1.50x5.50	4	AS	13¼	172	CNS	N	2.75x2.75	5	3.00x3.50	3.00x3.50	abce	⅞-18	Zen	....	2290	29¼	24	75	33
	.375	30	......	......	HG	Al	.....	1.00x3.50	3	AS	8	.....	CNS	N	2.75x2.75	5	3.00x3.50	3.00x3.50	abce	⅞-18	Zen	1¼	830	21⅛	17	51	34
	.375	30	E	Spec	HG	Al	40	1.00x3.50	4	DFS	8	36	Spec	N	2.00x1.50	7	2.50x1.31	2.50x2.12	abe	⅞-18	Zen	1½	820	21⅛	25	51	35
	.437	45	......	......	HG	CI	96	1.37x3.87	4	Dur	12¼	68	CNS	N	2.00x1.50	7	2.50x1.31	2.50x1.12	abe	⅞-18	Hol	....	1700	24½	27¾	68	36
	.437	45	......	......	HG	CI	104	1.37x4.12	4	Dur	12¼	68	CNS	N	2.25x2.37	7	2.75x3.25	2.75x2.12	abce	⅞-18	Hol	....	1700	24½	27¾	68	37
	.437	45	......	......	HG	CI	179	1.37x5.00	4	AS	12¼	96	CNS	N	2.25x2.37	7	2.75x3.25	2.75x2.12	abce	⅞-18	Zen(2)	1½	2500	26½	22¾	90½	38
	.437	45	......	......	HG	CI	179	1.37x5.00	4	AS	12¼	96	CNS	N	2.12x2.75	7	2.62x5.00	2.62x4.00	abe	⅞-18	Zen(2)	1½	2500	26½	29¾	88½	39
	.500	45	......	......	HG	CI	176	1.50x5.00	4	AS	13¼	164	CNS	N	2.12x2.75	7	2.62x5.00	2.62x4.00	abe	⅞-18	Hol	....	2435	24½	29⅜	78½	40
	.500	45	......	......	HG	CI	176	1.50x5.12	4	AS	13¼	164	CNS	N	2.75x2.75	7	3.00x3.37	3.00x3.25	abce	⅞-18	Hol	....	2460	24½	29⅜	78½	41
	.312	45	N	......	HG	CI	22	.750x....	3	1045	6½	22	1040	N	1.93x1.37	2	310(9)	310(9)	PS	18 mm	Zen	⅞	350	18	19 3/16	24	42
	.342	45	E	......	HG	CI	46	1.00x3.18	3	1040	7½	33	1045	Y	2.31x1.31	3	2.50x1.72	2.50x1.68	abcg	18 mm	Zen	⅞	550	16¾	31½	33	43
	.372	45	E	......	HG	CI	54	.989x3.31	4	1045	7½	60	1045	N	2.37x1.75	3	2.43x1.62	2.46x1.68	abcg	14 mm	Zen	1⅛	580	20	30	35½	44
	.372	45	E	......	HG	CI	70	.989x3.50	4	1045	7½	60	1045	N	2.37x1.75	3	2.43x1.62	2.46x4.50	abcg	14 mm	Zen	1⅛	580	20	31	35½	45
	.372	45	E	......	HG	CI	70	.989x3.50	4	1045	8	60	1045	N	2.37x1.75	3	2.43x1.62	2.46x1.93	abcg	14 mm	Zen	1⅛	580	20	30	35½	46
	433	45	E	......	HG	CI	107	1.50x3.93	4	1040	12½	102	1045	N	2.50x2.75	3	2.62x3.50	2.62x4.50	abcg	18 mm	Zen	1¼	1645	23	43½	45½	47
	433	45	E	......	HG	CI	107	1.50x3.93	4	1040	12½	102	1045	N	2.87x2.37	3	3.00x3.12	3.00x4.12	abcg	18 mm	Zen	1¼	1645	23	43½	45½	48
	433	45	E	......	HG	CI	128	1.50x4.37	4	1040	12½	102	1045	N	2.87x2.37	3	3.00x3.12	3.00x4.12	abcg	18 mm	Zen	1¼	1645	23	43½	45½	49
	624	45	E	......	HG	CI	283	1.75x6.25	4	1045	14	236	1045	N	3.50x3.75	3	3.93x5.25	3.93x5.25	abcg	18 mm	Zen	1¾	2500	34	59	62	50
	624	45	E	......	HG	CI	283	1.75x....	4	1045	14	236	4140	N	3.50x3.75	4	3.93x5.25	3.93x5.25	abcg	18 mm	Zen(2)	1½	3750	34	59	80	51
	624	45	E	......	HG	CI	255	1.75x6.12	4	3140	14	295	1045	Y	3.50x3.75	3	3.93x5.25	3.93x5.25	abcg	18 mm	Zen(2)	2	3900	45	65	64	52
	624	45	E	......	HG	CI	255	1.75x6.37	4	3140	14	295	4140	N	3.50x3.75	4	3.93x5.25	3.93x5.25	abcg	18 mm	Zen	1¾	5300	45	65	78	53
	341	45	E	CNM	HG	CI	56	1.00x3.00	4	DFS	9	54	DFS	N	2.62x1.28	2	SAE212(9)	3.00x2.18	abcefgt	14 mm	Sch	1	600	25¾	32 9/16	37 9/16	54
	341	45	E	CNM	HG	CI	53	1.00x3.00	4	DFS	9	54	DFS	N	2.62x1.28	2	BCA313(9)	BCA314(9)	bcefgt	14 mm	Sch	1	600	25¾	32 1/16	37 1/16	55
	134	45	E	CNM	HG	CI	80	1.25x3.87	4	DFS	10	90	DFS	N	2.57x2.21	3	2.90x2.18	2.90x3.50	abcefgt	⅞-18	Sch	1¼	1150	25¾	41 3/16	45 3/16	56
	134	45	E	CNM	HG	CI	110	1.25x4.25	4	DFS	11¼	100	DFS	N	2.75x2.09	3	2.90x2.18	2.90x3.50	abcefgt	⅞-18	Sch	1¼	1250	25¾	47⅝	45 3/16	57
	183	45	Bo	CNM	HG	CI	598	2.18x7.18	4	DFS	20½	656	DFS	N	3.50x4.37	3	3.50x5.21	3.50x6.37	abcdefgt	⅞-18	Zen	2	4700	38½	68¼	72	58
	134	45	E	CNM	HG	CI	80	1.25x3.87	4	DFS	10	90	DFS	Y	2.57x2.21	4	2.90x2.18	2.90x3.50	abcefgt	⅞-18	Zen	1½	1300	28¾	45 3/16	59¼	59
	134	45	E	CNM	HG	CI	104	1.25x4.25	4	DFS	11¼	100	DFS	Y	2.75x2.09	4	2.90x2.18	2.90x3.50	abcefgt	⅞-18	Zen	1½	1900	28¾	49 1/16	59¼	60
	83	45	Bo	CNM	HG	CI	598	2.18x7.18	4	DFS	20½	608	DFS	N	3.81x4.25	7	4.00x5.21	4.00x6.37	abcdefgt	⅞-18	Zen(2)	1¾	6650	37½	74	97	61
	41	45	E	CNM	HG	CI	53	1.00x3.00	4	DFS	8¾	45	DFS	N	2.62x1.28	3	SAE212(9)	3.00x2.18	abcefgt	14 mm	Sch	1	670	25¾	32 9/16	37⅞	62
	75	45	E	CA	HG	CI	45	.875x2.70	4	1045	6	29	1045	N	2.00x1.37	3	2.25x1.43	2.25x1.43	a	18 mm	Sch	1	345	17	24½	28½	63
	75	45	E	CA	HG	CI	83	1.31x3.81	4	1045	10½	68	1045	N	2.37x2.12	3	2.37x2.12	2.37x2.75	abcde	⅞-18	Sch	1¼	850	21¼	34¾	37¾	64
	37	45	E	CA	HG	CI	94	1.31x4.06	4	1045	10½	68	1045	N	2.37x2.12	3	2.37x2.12	2.37x2.75	abcde	⅞-18	Sch	1¼	850	21¼	24¾	37¾	65
	37	45	E	CA	HG	CI	109	1.50x4.37	4	1040	12½	145	1045	N	2.75x2.50	3	3.00x2.81	3.00x3.75	abcde	⅞-18	Sch	1¼	1200	24¼	44	44¼	66
	75	45	E	CA	HG	CI	109	1.50x4.37	4	1040	12½	145	1045	N	2.75x2.50	3	3.00x2.81	3.00x3.75	abcde	⅞-18	Sch	1¼	1200	24¼	44	44¼	67
	75	(h)	E	CA	HG	CI	39	.859x2.62	4	1030	7	28	1045	N	1.93x1.12	4	2.25x1.23	2.25x1.62	ab	18 mm	Zen	1¼	550	17½	29	31½	68
	75	(h)	E	CA	HG	CI	39	.859x2.62	4	1030	7	28	1045	N	1.93x1.12	4	2.25x1.23	2.25x1.62	ab	18 mm	Zen	1	530	17½	29	31½	69
		45	E	CA	HG	CI	45	.875x2.70	4	1045	6	29	1045	N	2.00x1.37	3	2.25x1.43	2.25x1.43	a	18 mm	Sch	1	355	17	24½	28½	70
	3	45	E	......	Ch	Al	26	.983x3.03	4	1035	10½	50	1045	Y	2.19x1.50	7	2.62x1.94	2.62x2.47	abcde	14 mm	Zen	1¼	763*	19¼	30¼	36¾	71
	3	45	E	......	Ch	Al	26	.983x3.03	4	1035	10½	50	1045	Y	2.19x1.50	7	2.62x1.94	2.62x2.47	abcde	14 mm	Zen	1½	780*	19¼	30⅝	36¾	72
	3	45		......	Ch	Al	29	.983x3.13	4	1035	10½	50	1045	Y	2.19x1.50	7	2.62x1.94	2.62x2.47	abcde	14 mm	Zen	1½	785*	19¼	30⅝	36¾	73
		30	......	......	HG	CI	29	.750x2.81	3	3140	6 9/16	21	1045	N	1.75x1.12	3	2.00x1.56	2.00x1.62	abr	⅞-18	Zen	1¼	410*	15½	21¾	32⅝	74
		30	......	......	HG	Al	.....	.750x2.81	3	AS	6 9/16	21	1045	N	1.75x1.12	3	2.00x1.56	2.00x1.62	abr	⅞-18	Zen	1¼	410*	15½	21¾	32⅝	75
		45	......	......	HG	Al	33	1.12x3.25	4	Dur	10½	41	NS	N	2.18x1.87	3	2.25x2.62	2.25x2.62	abc	18 mm	Str	1½	660*	23	28 9/16	45¼	76
		30	......	......	HG	Al	.....	.875x2.90	4	CS	7	26	CS‡	N	2.00x1.25		2.50x1.31	2.50x1.93	abr	14 mm	Zen	1½	675*	21	23¼	41⅛	77
		45	......	......	HG	Al	33	1.12x3.25	4	Dur	10½	41	NS	Y	2.18x1.87	4	2.25x2.62	2.25x2.62	abc	18 mm	Zen	1½	900*	19¾	28 13/16	56⅛	78
		45	......	......	HG	Al	40	1.00x3.51	4	1035	8	37	1045	N	2.00x1.50	7	2.50x1.31	2.50x2.12	abr	⅞-18	Zen	1¾	860*	21	26½	49¾	79
		45	E	Tun	HG	Al	49	1.25x3.68	4	AS	10⅞	70	NS	Y	2.75x2.25	4	3.25x2.25	3.25x2.25	abc	18 mm	Hol	2	1050*	27¾	32 9/16	56¾	80
		45	E	Tun	HG	Al	49	1.25x3.68	4	AS	10⅞	70	NS	Y	2.75x2.25	4	3.25x2.25	3.25x2.25	abc	18 mm	Str	2	1150*	24¾	29⅞	56¾	81
		45	......	......	HG	Al	50	1.37x3.84	4	AS	11¼	84	NS	Y	2.87x2.00	4	3.00x3.00	3.00x3.62	ab	18 mm	Hol	1½	1325*	26¼	36 9/16	66	82
		45	......	......	HG	Al	50	1.37x3.84	4	AS	11¼	84	NS	Y	2.87x2.00	4	3.00x3.00	3.00x3.62	ab	18 mm	Sch	1½	1420*	33½	33 1/16	66	83
		45	......	......	HG	Al	50	1.37x3.84	4	AS	11¼	84	NS	Y	2.87x2.00	4	3.00x3.00	3.00x3.62	ab	18 mm	Zen	2	1325*	33½	33 1/16	66	84
		45	......	......	HG	Al	56	1.37x4.00	4	AS	11¼	84	NS	Y	2.87x2.00	4	3.00x3.00	3.00x3.62	ab	18 mm	Hol	2	1325*	26¼	37 1/16	66	85
		45	......	......	HG	Al	56	1.37x4.00	4	AS	11¼	84	NS	Y	2.87x2.00	4	3.00x3.00	3.00x3.62	ab	18 mm	Sch	1½	1420*	33½	33 1/16	66	86
		45	......	......	HG	Al	56	1.37x4.00	4	AS	11¼	84	NS	Y	2.87x2.00	4	3.00x3.00	3.00x3.62	ab	18 mm	Hol	2	1325*	33½	33 1/16	66	87

(For abbreviations see pages 66 and 67)

American Gasoline

Line Number	Engine Make and Model	Designed for	Number of Cylinders, Bore and Stroke (In.)	Maximum Brake Hp. at Specified R.P.M.: With Bare Engine	Maximum Brake Hp. at Specified R.P.M.: With Standard Accessories	Piston Displacement (Cu. In.)	Compression Ratio	Maximum Torque at R.P.M. (Lb. Ft.) with or without Accessories	Cylinder Liners—Type	Crankcase—Upper Half Integral with Cylinders	Valves: Arrangement	Valves: Exhaust Head Material (S.A.E. No.)	Valves: Max. Head Diameter (In.) Intake	Valves: Max. Head Diameter (In.) Exhaust	Valves: Min. Port Diameter (In.) Intake	Valves: Min. Port Diameter (In.) Exhaust	Valves: Lift (In.) Intake	Valves: Lift (In.) Exhaust	Valves: Stem Diameter (In.) Intake	Valves: Stem Diameter (In.) Exhaust
1	Scripps.......202-203	M	6-5x5¾	....	212-2400	678.0	6.20	....	....	Se	L	Sil	2.56	2.28	....	....	.405	.375	.437	.437
2	Scripps.......206-207	M	6-5x5¾	....	170-2200	678.0	5.75	....	....	Se	L	Sil	2.56	2.28	....	....	.405	.375	.437	.437
3	Scripps.......208-209	M	6-5x5¾	....	225-2400	678.0	5.85	....	....	Se	L	Sil	2.50	2.37	....	....	.406	.375	.437	.437
4	Scripps.......214-215	M	6-5x5¾	....	185-2000	678.0	5.75	....	....	Se	L	Sil	2.50	2.37	....	....	.406	.375	.437	.437
5	Scripps.......V43-90, V47-90	M	8-3 1/16x3¾	....	90-3600	221.0	6.16	154-2200 (BE)	....	In	L	Sil	1.53	1.53	....	....	.296	.296	.312	.312
6	Scripps....V43M-100, V47M-100	M	8.3.185x3¾	....	100-3600	239.0	6.15	178-2200 (BE)	....	In	L	CNS	1.53	1.53	....	....	.292	.292	.311	.311
7	Scripps.......V63-130, V67-130	M	12-2 15/16x3¾	....	130-3600	305.0	6.70	232-2200 (BE)	....	In	L	CNS	1.53	1.53	....	....	.292	.292	.311	.311
8	Scripps.......302-303	M	12-4¼x5¼	....	304-2400	894.0	6.20	....	....	Se	L	Sil	2.25	2.25	....	....	.375	.375	.437	.437
9	Scripps.......304-305	M	12-4¼x5¼	....	250-2400	894.0	6.20	....	....	Se	L	Sil	2.25	2.25	....	....	.375	.375	.437	.437
10	Scripps.......306-307	M	12-4¼x5¼	....	280-2400	894.0	6.20	....	....	Se	L	Sil	2.25	2.25	....	....	.375	.375	.437	.437
11	Sterling.......Petrel L-6	M,T,Tr,B,Ind	6-5¼x6	....	115-1200	780.0	4.30	500-1400 (EA)	N	Se	L	Sil	2.25	2.25	....	....	.455	.455	.437	.437
12	Sterling.......Petrel L-6	M,T,Tr,B,Ind	6-5¼x6	....	145-1500	780.0	4.68	500-1400 (EA)	N	Se	L	Sil	2.25	2.25	....	....	.455	.455	.437	.437
13	Sterling.......Petrel L-6	M,T,Tr,B,Ind	6-5¼x6	....	145-1500	780.0	4.68	500-1400 (EA)	N	Se	L	Sil	2.25	2.25	....	....	.455	.455	.437	.437
14	Sterling.......Petrel L-6-6	M,T,Tr,B,Ind	6-5¼x6	....	180-1800	780.0	5.00	500-1400 (EA)	N	Se	L	Sil	2.25	2.25	....	....	.455	.455	.437	.437
15	Sterling......Petrel Reduction-L	M,T,Tr,B,Ind	6-5¼x6	....	175-1800	780.0	4.68	500-1400 (EA)	N	Se	L	Sil	2.25	2.25	....	....	.455	.455	.437	.437
16	Sterling.......Petrel L-6	M,T,Tr,B,Ind	6-5¼x6	....	200-2000	780.0	5.54	500-1400 (EA)	N	Se	L	Sil	2.25	2.25	....	....	.455	.455	.437	.437
17	Sterling.......Petrel L-6	M,T,Tr,B,Ind	6-5¼x6	....	225-2200	780.0	5.50	500-1400 (EA)	N	Se	L	Sil	2.25	2.25	....	....	.455	.455	.437	.437
18	Sterling...Dolphin-Med. GRM-6	Tr,M,Ind	6-5¾x6¾	....	165-1200	1051.6	3.85	785-1200 (EA)	N	Se	I	Sil	1.87	1.87	....	....	.375	.375	.437	.437
19	Sterling.......Dolphin 6-GR-6	Tr,M,Ind	6-5¾x6¾	....	225-1550	1051.6	4.08	785-1200 (EA)	N	Se	I	Sil	1.87	1.87	....	....	.375	.375	.437	.437
20	Sterling.......Dolphin 6-GRS-6	Tr,M,Ind	6-5¾x6¾	....	300-2000	1051.6	4.70	785-1200 (EA)	N	Se	I	Sil	1.87	1.87	....	....	.375	.375	.437	.437
21	Sterling.......Viking 11T-6	Tr,M,Ind	6-8x9	....	190- 600	2714.3	3.93	1900-1000 (EA)	W	Se	I	Sil	2.59	2.59	....	....	.556	.556	.562	.562
22	Sterling.......Viking 11T-6	Tr,M,Ind	6-8x9	....	300- 900	2714.3	4.18	1900-1000 (EA)	W	Se	I	Sil	2.59	2.59	....	....	.556	.556	.562	.562
23	Sterling.......Viking 11T-6	Tr,M,Ind	6-8x9	....	425-1200	2714.3	4.18	1900-1000 (EA)	W	Se	I	Sil	2.59	2.59	....	....	.556	.556	.562	.562
24	Sterling.......Viking 11 8-T-8	Tr,M,Ind	8-8x9	....	250- 600	3619.0	3.93	2520-1050 (EA)	W	Se	I	Sil	2.59	2.59	....	....	.556	.556	.557	.557
25	Sterling.......Viking 11 8-T-8	Tr,M,Ind	8-8x9	....	400- 900	3619.0	4.18	2520-1050 (EA)	W	Se	I	Sil	2.59	2.59	....	....	.556	.556	.557	.557
26	Sterling.......Viking 11 8-T-8	Tr,M,Ind	8-8x9	....	565-1200	3619.0	4.18	2520-1050 (EA)	W	Se	I	Sil	2.59	2.59	....	....	.556	.556	.557	.557
27	Sterling.......Viking 11TC68	M,Ind	8-8x9	....	600-1200	3619.0	5.00	2626-1200 (EA)	W	Se	I	Sil	2.59	2.59	....	....	.556	.556	.557	.557
28	Sterling......Admiral ‡V-2500-6	M,Ind	12-6⅜x6½	....	1200-2350	2500.0	6.00	.... (EA)	W	Se	I	CNS x	2.18	2.21	2.00	2.00	.437	.497	.403	.559
29	Sterling.....R. Admiral V-2500-7	M,Ind	12-6⅜x6½	....	800-2200	2500.0	6.00	.... (EA)	W	Se	I	CNS x	2.18	2.21	2.00	2.00	.437	.497	.403	.559
30	Sterling......Admiral V-2500-16	M,Ind	12-6⅜x6½	....	1800-2700	2500.0	6.46	....	W	Se	I	......	2.18	2.21	2.00	2.00	.437	.497	.403	.559
31	Thorobred (10).......KK	M	2-3¾x4¾	11-1100	10-1100	105.0	4.00	54-800 (EA)	N	Se	L	NCI	1.62	1.62	1.43	1.43	.300	.300	.375	.375
32	Thorobred.......DS	M	4-2¾x4	19-1800	16-1800	95.0	4.66	53-1300 (EA)	N	In	L	Sil	1.46	1.34	1.31	1.18	.250	.250	.312	.312
33	Thorobred.......Arrowhead, Jr.	M	4-3¼x4	38-2600	35-2600	133.0	5.58	92-1200 (EA)	N	In	L	Sil	1.34	1.34	1.18	1.18	.281	.281	.312	.312
34	Thorobred.......Arrowhead	M	4-3⅝x4½	40-2200	37-2200	186.0	5.50	128-900 (EA)	N	In	L	Sil	1.56	1.56	1.37	1.37	.281	.281	.375	.375
35	Thorobred.......AA	M	4-3¾x4¾	27-1400	24-1400	210.0	4.00	113-700 (EA)	N	Se	L	NCI	1.62	1.62	1.43	1.43	.300	.300	.375	.375
36	Thorobred.......F	M	4-4 1/16x5	39-1400	36-1400	259.0	4.00	142-1000 (EA)	N	Se	L	NCI	1.93	1.93	1.75	1.75	.300	.300	.375	.375
37	Thorobred.......B	M	4-4½x5	47-1800	44-1800	318.0	4.00	180-900 (EA)	N	Se	L	CNS	2.09	2.09	1.93	1.93	.300	.300	.375	.375
38	Thorobred.......BB-4	M	4-4½x6	59-1600	56-1600	382.0	4.00	224-1100 (EA)	N	Se	L	Sil	2.34	2.34	2.12	2.12	.300	.300	.437	.437
39	Thorobred.......BC-4	M	4-5x7	60-1200	56-1200	550.0	4.00	292-900 (EA)	N	Se	L	Dia	2.75	2.75	2.37	2.37	.375	.375	.625	.625
40	Thorobred.......BCS-4	M	4-5¾x7	75-1100	71-1100	727.0	4.00	409-900 (EA)	N	Se	L	Dia	2.75	2.75	2.37	2.37	.375	.375	.625	.625
41	Thorobred.......BC-Super-4	M	4-6x7	82-1100	78-1100	791.7	4.00	465-700 (EA)	N	Se	L	Dia	2.75	2.75	2.37	2.37	.375	.375	.625	.625
42	Thorobred.......Hiawatha	M	6-3¾x4¼	85-2800	82-2800	282.0	5.70	185-1100 (EA)	N	In	L	Sil	1.68	1.43	1.50	1.25	.375	.375	.375	.375
43	Thorobred.......Arrow-Super-6	M	6-4¼x4¾	98-2500	95-2500	404.0	5.38	286-800 (EA)	N	In	L	Sil	1.93	1.43	1.75	1.25	.375	.375	.375	.375
44	Thorobred.......BB-6	M	6-4½x6	84-1725	80-1725	572.5	4.00	379-900 (EA)	N	Se	L	Sil	2.34	2.34	2.12	2.12	.300	.300	.437	.437
45	Thorobred.......BBS-6	M	6-5x6	105-1500	101-1500	707.0	4.00	420-900 (EA)	N	Se	L	Sil	2.34	2.34	2.12	2.12	.300	.300	.437	.437
46	Thorobred.......BC-6	M	6-5x7	94-1100	90-1100	825.0	4.00	452-1000 (EA)	N	Se	L	Dia	2.75	2.75	2.37	2.37	.375	.375	.625	.625
47	Thorobred.......BCS-6	M	6-5¾x7	116-1100	112-1100	1091.0	4.00	596-850 (EA)	N	Se	L	Dia	2.75	2.75	2.37	2.37	.375	.375	.625	.625
48	Thorobred.......BC-Super-6	M	6-6x7	128-1100	124-1100	1187.5	4.00	630-875 (EA)	N	Se	L	Dia	2.75	2.75	2.37	2.37	.375	.375	.625	.625
49	Universal.......Fisherman-WM	M	1-4⅜x4½	....	8-1200	67.6	4.60	....	N	In	L	Sil	1.87	1.87	....	....	.250	.250	.375	.375
50	Universal.....Blue Jacket-AFTL	M	2-3x3½	....	12-2200	49.5	5.75	....	N	In	L	Sil	1.68	1.68	....	....	.250	.250	.375	.375
51	Universal.......Utility Four-BN	M	4-2¾x4	....	25-2500	95.0	4.70	....	N	In	L	Sil	1.25	1.25	....	....	.234	.234	.312	.312
52	Universal.......Flexifour-FA	M	4-3x3½	....	40-3500	99.0	6.00	....	N	In	L	Sil	1.68	1.68	....	....	.312	.312	.375	.375
53	Universal.......Superfour-LSG	M	4-3¼x4½	....	50-3000	149.3	5.70	....	N	Se	L	Sil	1.56	1.56	....	....	.312	.312	.375	.375
54	Universal..Blue Jacket Six-AMS	M	6-3x3½	....	60-3500	148.5	6.00	....	N	In	L	Sil	1.68	1.68	....	....	.312	.312	.375	.375
55	Universal......Cruiser Six-HCS	M	6-3½x4½	....	90-3000	260.0	5.75	....	N	Se	L	Sil	1.68	1.68	....	....	.312	.312	.375	.375
56	Universal.....Sea Lion Six-LHS	M	6-3½x4½	....	110-3400	260.0	5.75	....	N	Se	L	Sil	1.68	1.68	....	....	.312	.312	.375	.375
57	Universal.....Cruiser Eight-GCE	M	8-3½x4½	....	125-3000	347.0	5.75	....	N	Se	L	Sil	1.68	1.68	....	....	.328	.328	.375	.375
58	Universal....Sea Lion Eight-LCE	M	8-3½x4½	....	141-3400	347.0	5.75	....	N	Se	L	Sil	1.68	1.68	....	....	.328	.328	.375	.375
59	Waukesha.......(12) ICK	M,Ind	4-2½x3⅛	18-2600	14-2000	61.3	5.70	40-1700 (BE)	N	Se	L	Sil	1.12	.937	1.00	.812	.228	.250	.312	.312
60	Waukesha.......(12) FC	T,Tr,Ind	4-3¼x4	32-2600	24-1800	133.0	5.58	86-1200 (BE)	N	In	L	Sil	1.34	1.34	1.18	1.18	.281	.281	.312	.312
61	Waukesha.......(12) 160	Ind	4-3 5/16x3½	27-1800	....	120.5	6.00	85-1200 (BE)	W	In	I	Sil	1.18	1.12	1.06	1.00	.281	.281	.375	.375
62	Waukesha.......(12) XAH	T,Ind	4-3⅝x4½	43-2200	36-1800	186.0	5.50	120-900 (BE)	N	In	L	Sil	1.56	1.56	1.37	1.37	.302	.275	.375	.375
63	Waukesha.......(12) 130GS	T,Tr,Ind	4-3¾x5	50-2200	36-1500	221.0	6.12	144-800 (BE)	W	In	I	Sil	1.84	1.40	1.62	1.25	.445	.453	.434	.434
64	Waukesha.......(12) 130GL	T,Tr,Ind	4-4x5	56-2200	41-1500	251.0	5.95	164-800 (BE)	W	In	I	Sil	1.84	1.40	1.62	1.25	.445	.453	.434	.434
65	Waukesha.......(12) VIM	Tr,Ind	4-4¼x5¼	52-1600	45-1400	298.0	4.23	200-1000 (BE)	W	In	I	Sil	2.00	1.75	1.75	1.50	.400	.400	.375	.375
66	Waukesha.......(12) VIK	Tr,Ind	4-4½x5¼	58-1600	50-1400	334.0	4.30	224-900 (BE)	W	In	I	Sil	2.00	2.00	1.75	1.75	.400	.400	.375	.375
67	Waukesha.......(12) VRZG	T,Tr,Ind	4-4⅝x5¼	64-1600	56-1400	353.0	6.10	241-1100 (BE)	W	In	I	Sil	2.00	1.75	1.75	1.50	.450	.400	.375	.375
68	Waukesha.......(11) 6BZ	T,B,Ind	6-4x4¼	86-2800	65-2000	320.0	5.75	210-1000 (BE)	N	In	L	Sil	1.68	1.43	1.50	1.25	.375	.375	.375	.375
69	Waukesha.......(11) 6MKR	T,B,Ind	6-4⅛x4¾	98-2500	58-1600	381.0	5.34	270-800 (BE)	N	In	L	Sil	1.93	1.43	1.75	1.25	.375	.375	.375	.375
70	Waukesha.......(11) 6MZR	T,B,Ind	6-4¼x4¾	106-2500	69-1600	404.0	5.38	286-800 (BE)	N	In	L	Sil	1.93	1.43	1.75	1.25	.375	.375	.375	.375
71	Waukesha.......(11) 140-GS	T,B,Ind	6-4¼x5½	122-2250	114-2250	468.0	5.80	362-1000 (BE)	W	In	I	Sil	2.12	1.56	1.87	1.37	.531	.469	.434	.434
72	Waukesha.......(11) 140-GK	T,B,Ind	6-4½x5½	142-2250	133-2250	525.0	5.80	403-1000 (BE)	W	In	I	Sil	2.12	1.56	1.87	1.37	.531	.469	.434	.434
73	Waukesha.......(11) 6SRKR	T,B,Ind	6-4⅝x5⅛	125-2250	120-2250	517.0	5.50	369-600 (BE)	N	Se	L	Sil	2.16	1.65	1.87	1.37	.386	.375	.375	.375
74	Waukesha.......(11) 145-GS	T,B,Ind	6-4¾x6	152-2000	143-2000	638.0	5.60	481-1000 (BE)	W	In	I	Sil	2.37	1.84	2.12	1.62	.594	.531	.500	.500
75	Waukesha.......(11) 145-GK	T,B,Ind	6-5¼x6	186-2000	177-2000	779.0	5.60	590-1200 (BE)	W	In	I	Sil	2.37	1.84	2.12	1.62	.594	.531	.500	.500
76	Waukesha.......(12) 6WAL	T,B,Ind	6-5¾x6½	200-1800	162-1300	1013.0	5.00	735-800 (BE)	W	In	I	Sil	2.65	2.22	2.37	2.00	.656	.656	.500	.500
77	Waukesha.......(12) 6WAK	T,B,Ind	6-6¼x6½	235-1800	193-1300	1197.0	5.20	865-900 (BE)	W	In	I	Sil	2.65	2.22	2.37	2.00	.656	.656	.500	.500
78	Waukesha.......(12) 6NK	Ind	6-7x8½	221-1050	196- 950	1962.0	5.50	1330-600 (BE)	W	In	I	Sil	2.84	2.53	2.50	2.25	.718	.718	.562	.562
79	Waukesha.......(12) 6LRO	Ind	6-8½x8½	337-1050	300- 900	2894.0	3.80	1870-700 (BE)	N	Se	I	Sil	3.50	3.00	3.25	2.75	.750	.840	.562	.562
80	Waukesha.......145GZ	T,B,Tr,Ind	6-5⅜x6	203-2000	194-2000	817.0	6.00	585-1400 (BE)	W	In	I	Sil	2.37	1.84	2.12	1.62	.594	.531	.497	.496
81	White.......100A	T,B,	6-3 7/16x4½	90-2800	....	250.0	6.75	185-1200 (BE)	N	In	L	St	1.65	1.62	1.43	1.50	.381	.381	.375	.375
82	White.......110A	T,B	6-3 9/16x4½	100-2600	....	270.0	6.50	200-1300 (BE)	N	In	L	St	1.65	1.62	1.43	1.50	.381	.381	.375	.375
83	White.......120A	T,B	6-3⅞x4½	110-2600	....	318.0	6.40	285-1200 (BE)	N	In	L	Sil°)	1.65	1.62	1.43	1.50	.381	.381	.375	.437
84	White.......140A	T,B	6-3⅞x5⅛	125-2600	....	362.0	6.28	285-1100 (BE)	N	In	L	Sil°(x)	1.65	1.62	1.75	1.50	.381	.381	.375	.437
85	White.......(H) 140TA	B	6-3⅞x5⅛	....	125-2800	362.0	6.28	250-1200 (BE)	N	In	L	Sil°(x)	......	......	1.75	1.50	.375	.381	....	....
86	White.......(H) 24A	B	12-4⅛x4¼	....	209-2600	681.0	5.65	500-1200 (BE)	D	In	L	Sil°(x)	......	......	1.62	1.62	.375	.375	....	....
87	Willys.......442	C,T	4-3⅛x4⅜	63-3900	....	134.2	6.48	108-1800 (BE)	N	In	L	CNS	1.53	1.46	1.34	1.28	.351	.351	.373	.373
88	Wisconsin.......AK	M,Tr,Ind	1-2⅞x2¾	4.2-2400	4.2-2400	17.8	4.59	9.5-1700 (EA)	N	In	L	AUS	1.12	1.12	.937	.937	.187	.187	.310	.310
89	Wisconsin.......AHH	M,Tr,Ind	1-3⅝x4	9.2-2200	9.2-2200	41.3	4.50	26-1300 (EA)	N	Se	L	Sil	1.56	1.56	.812	1.25	.275	.275	.310	.310

(For abbreviations see pages 66 and 67)

Engines—*Continued*

Valves Seats: Angle (Deg.)	Valves Seats: Inserts Used?	Valves Seats: Insert Material (S.A.E. No.)	Camshaft Drive—Type	Pistons: Material	Pistons: Weight with Pins, Rings, Bushings (Oz.)	Pistons: Piston Pin—Diameter and Length (In.)	Number of Rings per Piston	Connecting Rods: Material	Connecting Rods: Center to Center Length (In.)	Connecting Rods: Weight with Bushing and Cap (Oz.)	Crankshaft: Material	Crankshaft: Counter Balance Used	Crankshaft: Crank-Pin Diameter and Length (In.)	Main Bearings: Number	Main Bearings Diameter and Length (In.): Front	Main Bearings Diameter and Length (In.): Rear	Oil Pressure to—	Spark Plug—Thread Size	Carburetor: Make	Carburetor: Size	Engine Weight without Carburetor or Ignition (Lb.)	Overall Dimensions (In.): Width	Overall Dimensions (In.): Height	Overall Dimensions (In.): Length	Line Number
45	.....	.....	HG	Al	62	1.37x4.00	4	AS	11¼	84	NS	Y	2.87x2.00	4	3.00x3.00	3.00x3.62	ab	18 mm	Hol	2	1325*	26¼	37 3/16	66	1
45	.....	.....	HG	Al	62	1.37x4.00	4	AS	11¼	84	NS	Y	2.87x2.00	4	3.00x3.00	3.00x3.62	ab	18 mm	Sch	1½	1420*	33½	33 7/16	66	2
45	.....	.....	HG	Al	56	1.37x4.00	4	AS	11¼	85	CS	Y	2.87x2.25	4	3.00x3.00	3.00x3.62	abr	18 mm	Zen(2)	2	1325*	25	33 7/16	66	3
45	.....	.....	HG	Al	56	1.37x4.00	4	AS	11¼	85	CS	Y	2.87x2.25	4	3.00x3.00	3.00x3.62	abr	18 mm	Zen(2)	2	1450*	25	33 7/16	66	4
45	Bo	Tun	HG	Al	.....	.750x2.84	3	AS	7	17	CS	Y	2.00x1.75	3	2.50x1.37	2.00x1.96	abc	18 mm	Str(2)	1	660*	23½	32⅜	42⅝	5
45	Bo	Tun	HG	CAS	.....	.750x2.84	3	DFS	7	18	CAS	Y	2.14x1.75	3	2.50x1.37	2.00x1.96	abc	14 mm	Hol	1	700*	23½	32⅞	43 1/16	6
45	Bo	Tun	HG	CAS	15	.750x2.48	3	DFS	7 11/16	22	CAS	Y	2.12x1.57	4	2.40x1.83	2.40x2.25	abc	14 mm	Str	1	.....	25⅜	31⅞	49 11/16	7
45	.....	.....	HG	Al	49	1.25x3.68	4	AS	10⅞	164⅛	NS	Y	2.75x2.25	4	3.25x2.25	3.25x2.25	abc	18 mm	Hol	2	1700*	35	33½	58½	8
45	.....	.....	HG	Al	49	1.25x3.68	4	AS	10⅞	164⅛	NS	Y	2.75x2.25	4	3.25x2.25	3.25x2.25	abc	18 mm	Str(2)	....	1700*	33¼	30 7/16	58½	9
45	.....	.....	HG	Al	49	1.25x3.68	4	AS	10⅞	164⅛	NS	Y	2.75x2.25	4	3.25x2.25	3.25x2.25	abc	18 mm	Str(2)	2	1700*	33¼	30 7/16	58½	10
45	E	T-12	HG	Al	94	1.43x4.37	4	CS	12½	113	CNS	Y	2.50x2.12	7	3.00x1.75	3.00x2.87	abcdef	⅞-18	Zen(2)	1½	1400	27½	33½	71¾	11
45	E	T-12	HG	Al	94	1.43x4.37	4	CS	12½	113	CNS	Y	2.50x2.12	7	3.00x1.75	3.00x2.87	abcdef	⅞-18	Zen(2)	1½	1400	27½	33½	71¾	12
45	E	T-12	HG	Al	94	1.43x4.37	4	CS	12½	113	CNS	Y	2.50x2.12	7	3.00x1.75	3.00x2.87	abcdef	⅞-18	Zen(2)	1½	1850	27½	33½	71¾	13
45	E	T-12	HG	Al	94	1.43x4.37	4	CS	12½	113	CNS	Y	2.50x2.12	7	3.00x1.75	3.00x2.87	abcdef	⅞-18	Zen(2)	1¾	1400	27½	33½	71¾	14
45	E	T-12	HG	Al	94	1.43x4.37	4	CS	12½	113	CNS	Y	2.50x2.12	7	3.00x1.75	3.00x2.87	abcdef	⅞-18	Zen(2)	1½	2000	27 7/16	23	81 1/16	15
45	E	T-12	HG	Al	94	1.43x4.37	4	CS	12½	113	CNS	Y	2.50x2.12	7	3.00x1.75	3.00x2.87	abcdef	⅞-18	Zen(2)	1¾	2000	27½	33½	71¾	16
45	E	T-12	HG	Al	94	1.43x4.37	4	CS	12½	113	CNS	Y	2.50x2.12	7	3.00x1.75	3.00x2.87	abcdef	⅞-18	Zen(2)	1½	2000	27½	33½	71¾	17
60	N	.....	HG	Al	100	1.25x5.12	3	CS	14	130	CNS	Y	2.50x3.00	4	2.50x4.43	2.50x4.43	abcdef	⅞-18	Zen(2)	1¾	2250	30½	45⅛	87½	18
60	N	.....	HG	Al	100	1.25x5.12	3	CS	14	130	CNS	Y	2.50x3.00	4	2.50x4.43	2.50x4.43	abcdef	⅞-18	Zen(2)	1¾	2000	30½	45⅛	87½	19
60	N	.....	HG	Al	110	1.25x5.12	3	CS	14	130	CNS	Y	2.50x3.00	4	2.50x4.43	2.50x4.43	abcdef	⅞-18	Zen(2)	2½	2175	30½	45⅛	87½	20
45	E	T-12	Ch	Al	280	2.00x7.00	4	CS	18	416	CNS	Y	4.00x3.12	7	4.00x3.37	4.00x5.50	abcdef	⅞-18	Zen(3)	2½	7100	40⅛	72¾	121⅜	21
45	E	T-12	Ch	Al	290	2.00x7.00	4	CS	18	416	CNS	Y	4.00x3.12	7	4.00x3.37	4.00x5.50	abcdef	⅞-18	Zen(3)	2½	7100	40⅛	72¾	121⅜	22
45	E	T-12	Ch	Al	290	2.00x7.00	4	CS	18	416	CNS	Y	4.00x3.12	7	4.00x3.37	4.00x5.50	abcdef	⅞-18	Zen(3)	2½	7100	40⅛	72¾	121⅜	23
45	E	T-12	Ch	Al	280	2.00x7.00	4	CS	18	416	CNS	Y	4.00x3.12	9	4.00x3.37	4.00x5.50	abcdef	⅞-18	Zen(4)	2½	9000	40⅛	72¾	142⅜	24
45	E	T-12	Ch	Al	290	2.00x7.00	4	CS	18	416	CNS	Y	4.00x3.12	9	4.00x3.37	4.00x5.50	abcdef	⅞-18	Zen(4)	2½	9000	40⅛	72¾	142⅜	25
45	E	T-12	Ch	Al	290	2.00x7.00	4	CS	18	416	CNS	Y	4.00x3.12	9	4.00x3.37	4.00x5.50	abcdef	⅞-18	Zen(4)	2½	9000	40⅛	72¾	142⅜	26
45	E	T-12	Ch	Al	.....	2.00x7.00	4	CS	18	416	CNS	Y	4.00x3.12	9	4.00x3.37	4.00x5.50	abcdef	⅞-18	Zen(4)	2½	9900	44	64	144½	27
45	Bo	JM	HG	Al	96	1.62x5.90	6	4340	‡‡	48	4140	Y	3.50x2.87	7	4.00x3.00	4.00x3.00	abce	⅝-24	Str	....	4200	50	50	108⅝	28
45	Bo	JM	HG	Al	96	1.62x5.90	6	4340	‡‡	48	4140	Y	3.50x2.87	7	4.00x3.00	4.00x3.00	abce	⅝-24	Str	....	3950	50	50	108⅝	29
45	Bo	JM	HG	Al	140	1.62x5.90	5	4340	‡‡	48	4140	Y	3.50x2.87	7	4.00x3.00	4.00x3.00	abce	⅝-24	Ben	....	4000	50	53½	107 11/16	30
45	N	.....	HG	CIA	64	1.10x3.25	3	1045	8½	43	1045	N	1.50x2.12	2	1.50x3.00	1.50x3.00	Splash	⅞-18	Str	1	415	19½	22 13/16	38¼	31
45	N	.....	HG	CIA	19	.625x2.40	3	1045	8	27	1045	N	1.75x1.50	2	1.76x2.81	1.73x2.87	abe	⅞-18	Str	¾	330	15⅞	21⅛	38⅛	32
45	N	.....	HG	CI	30	.875x2.75	3	1045	7¼	29	1045	N	1.75x1.25	3	2.12x1.43	2.12x1.18	abcde	18 mm	Str	1	490	21⅜	24 3/16	35	33
45	E	CA	HG	CI	45	1.10x3.06	4	1045	8¾	46	1045	N	2.00x1.50	3	2.00x2.50	2.00x1.87	abcde	⅞-18	Str	1	610	19⅛	26¼	41	34
45	N	.....	HG	CIA	64	1.10x3.25	3	1045	8½	43	1045	N	1.50x2.12	3	1.50x3.00	1.50x3.00	abe	⅞-18	Str	1	620	19½	22 13/16	46⅝	35
45	N	.....	HG	CIA	69	1.10x3.56	4	1045	10⅜	66	1045	N	2.00x2.25	3	2.00x4.18	2.00x3.50	abe	⅞-18	Str	1¼	830	20¼	28 11/16	54⅜	36
45	N	.....	HG	CIA	89	1.10x3.93	4	1045	10⅜	66	1045	N	2.00x2.25	3	2.00x4.18	2.00x3.50	abe	⅞-18	Str	1½	830	20¼	26 11/16	54⅜	37
45	N	.....	HG	CIA	82	1.25x3.87	4	1045	11⅜	87	1045	N	2.56x2.25	5	2.56x4.25	2.56x4.25	abce	⅞-18	Str	1½	1175	22¾	27 1/16	59 3/16	38
45	N	.....	HG	CIA	126	1.43x4.68	4	1045	13¼	168	1045	N	2.56x3.00	5	2.62x4.50	2.62x4.50	abcde	⅞-18	Str	2	1720	25⅞	37⅜	74 1/16	39
45	N	.....	HG	CIA	150	1.43x5.25	4	1045	13¼	168	1045	N	2.56x3.00	5	2.62x4.50	2.62x4.50	abcde	⅞-18	Str	2	1730	25⅞	37⅜	74 1/16	40
45	N	.....	HG	CIA	190	1.43x5.50	4	1045	13¼	168	1045	N	2.56x3.00	5	2.62x4.50	2.62x4.50	abcde	⅞-18	Str	2	1740	25⅞	37⅜	74 1/16	41
45	E	CA	HG	Al	37	1.00x3.50	4	1045	8	40	1045	N	2.00x1.50	7	2.62x2.00	2.62x1.25	abcde	18 mm	Str	1¼	1000	22½	28¼	53 13/16	42
45	E	CA	HG	Al	48	1.00x4.00	4	1045	8¾	48	1045	N	2.25x1.50	7	2.62x2.75	2.62x1.62	abcde	14 mm	Str	1¼	1185	20¼	27⅞	57 11/16	43
45	N	.....	HG	CIA	82	1.25x3.87	4	1045	11⅜	87	1045	N	2.56x2.25	7	2.56x4.25	2.56x4.25	abce	⅞-18	Str	1½	1475	23⅜	33¼	72 9/16	44
45	N	.....	HG	CIA	106	1.25x4.31	4	1045	11⅜	87	1045	N	2.56x2.25	7	2.56x4.25	2.56x4.25	abce	⅞-18	Str	2	1565	24⅛	33¼	72¾	45
45	N	.....	HG	CIA	126	1.43x4.68	4	1045	13¼	168	1045	N	2.56x3.00	7	2.62x4.50	2.62x4.50	abcde	⅞-18	Str	2	2330	27⅛	37⅜	91⅜	46
45	N	.....	HG	CIA	150	1.43x5.25	4	1045	13¼	168	1045	N	2.56x3.00	7	2.62x4.50	2.62x4.50	abcde	⅞-18	Str	2	2360	27⅛	37⅜	91⅜	47
45	N	.....	HG	CIA	190	1.43x5.50	4	1045	13¼	168	1045	N	2.56x3.00	7	2.62x4.50	2.62x4.50	abcde	⅞-18	Str	2	2380	27⅛	37⅜	91⅜	48
45	N	.....	HG	CI	.....	1.00x3.75	3	Al	8½	.....	CS	Y	2.00x2.00	2	2.00x2.00	2.00x2.00	Splash	18 mm	Str	⅝	200	15 3/16	24⅜	17 9/16	49
45	N	.....	HG	Als	15	.750x2.56	4	CS	7¼	26	CS	Y	1.75x1.37	2	1.75x1.87	1.75x2.00	abce	18 mm	Zen	⅝	300	20 7/16	22⅝	28⅛	50
45	N	.....	HG	CI	19	.625x2.44	3	CS	7½	22	CS	N	1.50x1.75	2	1.50x2.75	1.50x2.75	abce	18 mm	Zen	1	347	17 3/16	21 7/16	34 11/16	51
45	N	.....	HG	Al	15	.750x2.56	4	Al	7¼	18	CS	Y	1.75x1.37	3	1.75x2.50	1.75x2.50	abce	18 mm	Zen	1	400	19 3/16	22⅝	34 11/16	52
45	N	.....	HG	Al	20	.875x2.75	4	Al	8½	30	CS	N	2.00x1.75	3	2.00x2.50	2.00x2.50	abc	18 mm	Zen	1	520	18½	25¼	39⅝	53
45	N	.....	HG	Al	15	.750x2.56	4	Al	7¼	18	CS	Y	1.75x1.37	4	1.75x2.50	1.75x2.50	abce	18 mm	Zen	1¼	515	24	20¾	43⅞	54
45	N	.....	HG	Al	28	.875x3.00	4	Al	8½	28	CS	N	2.00x1.87	7	2.00x2.56	2.00x2.56	abce	18 mm	Str	1¼	775	20 1/16	26¾	49 11/16	55
45	N	.....	HG	Al	28	.875x3.00	4	Al	8½	28	CS	N	2.00x1.87	7	2.00x2.56	2.00x2.56	abce	18 mm	Str	1¾	810	22 3/16	26¾	49 11/16	56
45	N	.....	HG	Al	28	.875x3.00	4	Al	8½	28	CS	N	2.00x1.87	9	2.00x2.56	2.00x2.56	abce	18 mm	Str	1¾	1050	21 3/16	26 3/16	62⅝	57
45	N	.....	HG	Al	28	.875x3.00	4	Al	8½	28	CS	N	2.00x1.87	9	2.00x2.56	2.00x2.56	abce	18 mm	Str(2)	1½	1100	22¾	26 3/16	62⅝	58
45	N	.....	HG	Al	8	.625x2.12	4	1045	6	14	1045	N	1.56x1.25	2(9)	ND1207	ND1207	abcde	14 mm	Op	⅝	143	14 11/16	20½	21 11/16	59
45	E	CA	HG	CI	30	.875x2.75	4	1045	7¼	29	1045	N	1.75x1.06	3	2.12x1.18	2.12x1.43	abcde	18 mm	Op	1	290	19	26¾	27¾	60
45	N	.....	HG	CI	43	.875x2.68	5	1045	6	28	1045	N	2.00x1.37	3	2.25x1.62	2.25x1.62	a	18 mm	Op	1	335	17¼	25⅜	28½	61
45	E	CA	HG	CI	45	1.12x3.03	4	1045	8¾	46	1045	N	2.00x1.50	3	2.00x1.87	2.00x2.50	abcde	⅞-18	Op	1	385	17⅞	27	32⅞	62
(h)	E	CA	HG	CI	58	1.12x3.06	4	1045	8¾	57	1045	N	2.25x1.75	3	2.62x1.75	2.62x2.25	abcdeg	18 mm	Op	1¼	670	21½	38¾	33 3/16	63
(h)	E	CA	HG	CI	69	1.12x3.31	4	1045	8¾	57	1045	N	2.25x1.75	3	2.62x1.75	2.62x2.25	abcdeg	18 mm	Op	1¼	680	21½	38¾	33 3/16	64
45	E	CA	HG	CI	76	1.31x3.87	4	1045	10½	86	1045	N	2.37x2.12	3	2.37x2.12	2.37x2.75	abcdeg	⅞-18	Op	1¼	875	21¼	35	37⅞	65
45	E	CA	HG	CI	85	1.31x4.06	4	1045	10½	86	1045	N	2.37x2.12	3	2.37x2.12	2.37x2.75	abcdeg	⅞-18	Op	1¼	925	21¼	35	37⅞	66
45	E	CA	HG	CI	96	1.31x4.06	4	1045	10½	86	1045	N	2.37x2.12	3	2.37x2.31	2.37x2.75	abcdeg	18 mm	Op	1¼	1025	20¼	37 11/16	39⅞	67
45	E	CA	HG	Al	46	1.00x3.85	4	1045	8	40	1045	N	2.00x1.50	7	2.62x1.25	2.62x2.00	abcde	18 mm	Op	1½	706	19¼	31	39½	68
45	E	CA	HG	Al	45	1.00x3.85	4	1045	8¾	45	1045	N	2.25x1.50	7	2.62x1.62	2.62x2.75	abcde	18 mm	Op	1½	890	20⅞	34¾	43 11/16	69
45	E	CA	HG	Al	45	1.00x4.00	4	1045	8¾	48	1045	N	2.25x1.50	7	2.62x1.62	2.62x2.75	abcde	18 mm	Op	1¾	920	20⅞	34¾	43 11/16	70
(h)	E	CA	HG	Al	60	1.37x3.62	4	1045	10¼	85	1045	N	2.62x2.00	7	3.25x1.75	3.25x3.00	abcdeg	18 mm	Op	1¾	1350	23⅝	41 11/16	50⅝	71
(h)	E	CA	HG	Al	64	1.37x3.87	4	1045	10¼	85	1045	N	2.62x2.00	7	3.25x1.75	3.25x3.00	abcdeg	18 mm	Op	1¾	1390	23⅝	41 11/16	50⅝	72
30	E	CA	HG	Al	70	1.37x4.25	4	1045	10¼	83	1045	N	2.75x1.75	7	3.00x1.87	3.00x3.00	abcde	⅞-18	Op	1¾	1225	24⅛	39⅝	46 5/16	73
45	E	CA	HG	Al	.....	1.62x4.37	4	1045	11¾	133	1045	N	3.00x2.25	7	3.50x2.00	3.50x3.50	abcdeg	18 mm	Op	2	1900	25¾	46⅜	55 11/16	74
(h)	E	CA	HG	Al	103	1.62x4.87	4	1045	11¾	133	1045	N	3.00x2.25	7	3.50x2.00	3.50x3.50	abcdeg	18 mm	Op	2	1930	25¾	46⅜	55 11/16	75
(h)	E	CA	HG	CI	262	1.87x5.00	4	1045	13¼	195	1045	N	3.37x2.37	7	4.00x2.56	4.00x3.56	abcdeg	18 mm	Op	2½	3000	30⅝	50⅞	65⅝	76
(h)	E	CA	HG	CI	292	1.87x5.50	4	1045	13¼	195	1045	N	3.37x2.37	7	4.00x2.56	4.00x3.56	abcdeg	18 mm	Op	2½	3050	30⅝	50⅞	65⅝	77
(h)	E	CA	HG	CI	304	2.00x6.00	4	1045	15⅜	314	1045	N	3.25x2.75	7	3.75x3.75	3.75x5.50	abcdeg	18 mm	Op	2½	5900	31 11/16	61 11/16	76	78
30	E	CA	HG	CI	778	2.25x7.75	5	1045	18⅝	474	1045	N	4.00x3.75	7	4.25x4.81	4.25x5.50	abcdeg	⅞-18	Op(2)	2½	10640	48¼	65	95¼	79
(h)	E	TS	HG	Al	110	1.62x4.50	4	1045	11¾	133	1045	N	3.00x2.25	7	3.50x2.00	3.50x3.50	abcdeg	18 mm	Op	2	1950	25¾	46⅜	55 11/16	80
45	E	St	HG	Al	38	1.00x3.03	5	1040	9 11/16	40	1050	Y	2.18x1.34	7	3.00x1.84	3.00x1.93	abcde	14 mm	Str(Dp)	1¼	973	29⅝	40⅝	44¼	81
45	E	St	HG	Al	43	1.00x3.03	5	1040	9 11/16	52	1050	Y	2.18x1.34	7	3.00x1.84	3.00x1.93	abcde	14 mm	Str(Dp)	1¼	973	29⅝	40⅝	44¼	82
45	E	St	HG	Al	45	1.00x3.46	5	1040	9 11/16	52	1050	Y	2.18x1.34	7	3.00x1.84	3.00x1.93	abcde	14 mm	Str(Dp)	1¼	993	29⅝	40⅝	44¼	83
45	E	St	HG	Al	45	1.00x3.46	5	1040	9 11/16	52	1040	Y	2.18x1.34	7	3.00x1.84	3.00x1.93	abcdef	18 mm	Str(Dp)	1¼	1051	29⅝	40⅝	44¼	84
45	E	St	HG	Al	45	1.00x3.46	5	.....	9 11/16	52	.....	Y	2.18x1.34	7	3.00x1.84	3.00x1.93	abcdef	18 mm	Str(Dp)	1¼	1280*	.....	.....	.....	85
.....	E	St	HG	Al	30	1.18x-.—	5	.....	8 1/16	.....	.....	Y	2.43x2.31	7	2.87x2.09	2.87x2.40	abcdef	18 mm	Zen(Dp)	.....	2275*	.....	.....	.....	86
45	N	N	Ch	CI	24	.812x2.78	3	MS	9 1/16	34	1040	Y	1.94x1.30	3	2.33x1.92	2.33x1.75	abce	14 mm	Car	1¼	364	19	26⅜	29¼	87
45	E	Mo	HG	Al	10	.625x2.37	4	Al	6	6	1045	Y	1.00x1.00	2	(9)	(9)	......	18 mm	Str	⅝	70*	17¾	16¾	15	88
45	Bo	Mo	HG	Al	26	.937x3.00	4	1035	9½	33	1045	Y	1.37x1.37	2	(9)	(9)	......	18 mm	Str	1	180*	18⅞	24⅜	18¼	89

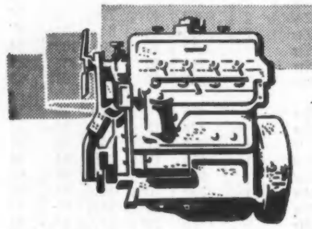
(For abbreviations see pages 66 and 67)

American Gasoline En

Line Number	Engine Make and Model	Designed for	Number of Cylinders, Bore and Stroke (In.)	Maximum Brake Hp. at Specified R.P.M.: With Bare Engine	With Standard Accessories	Piston Displacement (Cu. In.)	Compression Ratio	Maximum Torque at R.P.M. (Lb. Ft.) with or without Accessories	Cylinder Liners—Type	Crankcase—Upper Half Integral with Cylinders	Valves: Arrangement	Exhaust Head Material (S.A.E. No.)	Max. Head Diameter (In.): Intake	Exhaust	Min. Port Diameter (In.): Intake	Exhaust	Lift (In.): Intake	Exhaust	Stem Diameter (In.): Intake	Exhaust
1	Wisconsin.........VB-4	M,Tr,Ind	4-2½x2¾	11.4-2600	11.4-2600	54.0	4.75	28-1600 (EA)	N	Se	L	AUS	1.13	1.13	.938	.938	.275	.275	.309	.309
2	Wisconsin.........VL-4	M,Tr,Ind	4-2¾x2¾	14.1-2600	14.1-2600	65.0	4.75	33.5-1600 (EA)	N	Se	L	AUS	1.13	1.13	.938	.938	.275	.275	.309	.309
3	Wisconsin.........VE-4	M,Tr,Ind	4-3x3¼	22-2600	22-2600	91.9	4.60	50-1600 (EA)	N	Se	L	AUS	1.31	1.31	1.12	1.12	.275	.275	.309	.309
4	Wisconsin.........VF-4	M,Tr,Ind	4-3¼x3¼	25-2400	25-2400	107.7	4.60	57-1600 (EA)	N	Se	L	AUS	1.31	1.31	1.12	1.12	.275	.275	.309	.309
5	Wisconsin.........VM-4	Tr,Ind	4-3¼x3½	28-2200	28-2200	132.7	4.75	72.5-1600 (EA)	N	Se	L	AUS	1.56	1.56	1.37	1.37	.275	.275	.309	.309
6	Wisconsin.........VP-4	Tr,Ind	4-3½x3½	31-2200	31-2200	154.0	4.75	86-1600 (EA)	N	Se	L	AUS	1.56	1.56	1.37	1.37	.275	.275	.309	.309
7	Wisconsin..........	....	For other engines see SMALL GASOLINE POWER UNITS table																	

ABBREVIATIONS

§—Used in Bus engines; no liners used in truck engines °—Stellite faced
*—Weight complete with ignition and carburetor
**—Pressure also to Camshaft thrust bearing
■—Also available in reduction gear models
▼—Also available in R.H. rotation
‡—Tocco hardened ♠—Weight per pair
†—Rated with generator and water pump, but no fan or muffler
††—1500 lbs. for model 179; model 178 includes reduction gear and weighs 1905 lb. complete
‡—Super-Charged engine
‡‡—8¾ in. for link rod; 12 in. for master rod
(1)—6.20 ratio for Cars, 5.90 for heavy duty truck engine
(2)—Two used (3)—Three used
(4)—Four used
(5)—156 ft. lb. torque at 2200 for cars; 156 ft. lb. at 2000 for heavy duty truck engine
(6)—41⅜ in. for 178 model; 36⅞ in. for 179 model
(7)—76 7116 in. for 178 model; 62⅝ in. for 179 model
(8)—Minneapolis Moline Power Implement Co. (9)—Ball Bearings
(10)—Red Wing Motor Co.
(11)—Automotive Power Ratings
(12)—Industrial Power Ratings
a—Main Bearings
(aa)—Forked rod, 88 oz.; Plain Rod, 50 oz.
Al—Aluminum Alloy
Ala—Aluminum Alloy, Anodized
Als—Aluminum Alloy with Steel Strut
AS—Alloy Steel AUS—Austenitic Steel
Ay—Alloy Iron B—Buses
b—Connecting Rods
(BE)—Bare Engine BG—Bevel Gear
Bo—Used in both Intake and Exhaust seats
c—Camshaft Bearings C—Cars
CA—Cast Alloy Car—Carter Carburetor
CAS—Cast Alloy Steel Ch—Chain
CHS—Chrome Nickel Silicon Steel
CI—Cast Iron CIA—Cast Iron, Anodized
CM—Chrome Molybdenum
CMT—Chromium Tungsten Steel
CNI—Chrome Nickel Iron
CNM—Chrome Nickel Molybdenum
CNS—Chrome Nickel Steel
CNT—Chrome Nickel Steel with Tungsten
CS—Carbon Steel
CSC—Carbon Steel, Case Hardened
CT—Cast Iron, Tin Plated
d—Wrist Pins D—Dry Liners



AUTOMOTIVE DIESEL

Line Number	Engine Make and Model	Built Under License from	Designed for	Type	Number of Cylinders Bore and Stroke (In.)	Cylinder Liners—Type	Cycle	Piston Displacement (Cu. In.)	With Bare Engine: Maximum Brake Hp. at Specified R.P.M.	With Standard Accessories: Max. Intermittent Hp. at Specified R.P.M.	Continuous Sustained Hp. at Specified R.P.M.	Compression Ratio - to 1	Max. Combustion Pressure (Lb. per Sq. In.)	B.M.E.P. at Continuous Hp. (Lb. per Sq. In.)	Weight per Continuous Hp. (Lb.)	Max. Torque in Lb. Ft. at Specified R.P.M.	Shipping Weight (Lb.): Automotive or Industrial	Marine	Valves: Arrangement	Intake Port Diameter and Lift (In.)
1	Atlas Imperial...1LN29	Lanova	I	AC	1-3½x3¾	W	4	29	6.5-1800	5.7-1800	5-1800	15.50	750	76	72.8♠	15-1100	364	......	VI	1.06-.390
2	Atlas Imperial...3LN29	Lanova	I	AC	3-3½x3¾	W	4	87	20-1800	16.5-1800	15-1800	15.50	750	76	40.3♠	45-1100	604	......	VI	1.06-.390
3	Buda.......4-DT-212	Lanova	C,T,Tr,R	AC	4-3⅞x5⅛	D	4	212	60.5-2300	49-2300	37-1800	14.50	725	77	25.7♠	123.5-1400	950	......	VI	1.37-.486
4	Buda.....4-DTM-212	Lanova	M	AC	4-3⅞x5⅛	D	4	212	60.5-2300	50-2100	40-1800	14.50	725	83	24.6	132-1400	....	985	VI	1.37-.486
5	Buda.......4-DT-226	Lanova	C,T,Tr,R	AC	4-3¾x5⅛	D	4	226	58.5-2000	48-2000	39-1800	14.50	725	76	24.3♠	132-1400	950	......	VI	1.37-.486
6	Buda.......6-DT-278	Lanova	C,T,Tr,B	AC	6-3⅝x4½	D	4	278	82-2600	69-2600	47-1800	14.50	725	74	23.5♠	161.8-1500	1105	......	VI	1.37-.486
7	Buda.......6-DT-294	Lanova	C,T,Tr,B	AC	6-3⅝x4¾	D	4	294	85-2400	71-2400	51-1800	14.50	725	76	21.9♠	177-1500	1115	......	VI	1.37-.486
8	Buda.......6-DT-317	Lanova	C,T,Tr,B	AC	6-3¾x4¾	D	4	317	90-2300	75-2300	52.5-1800	14.50	725	73	21.6♠	185.4-1500	1133	......	VI	1.37-.486
9	Buda.....6-DTM-317	Lanova	M	AC	6-3¾x4¾	D	4	317	90-2300	75-2100	56-1800	14.50	725	78	22.3	195-1500	....	1250	VI	1.37-.486
10	Buda.......6-DT-389	Lanova	T,Tr,B	AC	6-3⅞x5½	D	4	389	96-2100	74.5-2100	57-1600	14.20	725	73	24.5♠	222.5-1100	1400	......	VI	1.44-.476
11	Buda.......6-DT-468	Lanova	T,Tr,B	AC	6-4¼x5½	D	4	468	113-2000	89-2000	68-1600	14.20	725	72	21.1♠	268.5-1100	1435	......	VI	1.59-.476
12	Buda.....6-DTM-468	Lanova	M	AC	6-4¼x5½	D	4	468	113-2000	97-1800	75-1600	14.20	725	79	23.7	308-1100	....	1775	VI	1.59-.476
13	Buda......6-DHM-909	Lanova	M	AC	6-5¼x7	W	4	909	169-1500	152-1500	117-1200	13.60	725	85	28.6	569- 900	....	3350	VI	1.90-.540
14	Buda........6DC-1611	Lanova	R,I	AC	6-6¼x8¾	W	4	1611	217-1100	176-1100	135- 900	13.00	725	75	50.9♠	917- 650	6875	......	VI	2.25-.687
15	Buda........6DC-1742	Lanova	R,I	AC	6-6½x8¾	W	4	1742	234-1100	192-1100	146- 900	13.00	725	74	47.3♠	991- 650	6900	......	VI	2.37-.687
16	Buda........6DC-1879	Lanova	R,I	AC	6-6¾x8¾	W	4	1879	248-1100	203-1100	155- 900	13.00	725	73	44.8♠	1043- 650	6950	......	VI	2.50-.687
17	Buda......6DCM-1879	Lanova	M	AC	6-6¾x8¾	W	4	1879	248-1100	222-1100	186-1000	13.00	725	78	34.9	1140- 650	....	6500	VI	2.50-.687
18	Buda.....6-PH-D1879	Lanova	I	AC	6-6¾x8¾	W	4	1879	248-1100	203-1100	155- 900	13.00	725	73	58.1♠	1043- 650	9000	......	VI	2.50-.687
19	Buda........6-DC-844	Lanova	T,Tr,B,I	AC	6-5¼x6½	W	4	844	180-1800	150-1800	96-1200	13.00	725	75	29.8♠	460-1100	2850	......	VI	2.00-.540
20	Buda......6-DCM-844	Lanova	M	AC	6-5¼x6½	W	4	844	180-1800	158-1800	112-1300	13.00	725	81	34.8	518-1100	....	3900	VI	2.00-.540
21	Buda.....*6-DCS-844	Lanova	T,B,Tr,I	AC	6-5¼x6½	W	4	844	225-1800	185-1800	140-1400	.....	725	94	......	530-1250		......	VI	2.00-.540
22	Buda....6-DCSM-844	Lanova	M	AC	6-5¼x6½	W	4	844	225-1800	195-1800	147-1400	.....	725	99	......	635-1250		......	VI	2.00-.540
23	Buda........6-DC-1125	Lanova	T,R,I	AC	8-5¼x6½	W	4	1125	239-1800	197-1800	148-1400	13.00	725	75	......	570-1100		......	VI	2.00-.540
24	Buda......8DCM-1125	Lanova	M	AC	8-5¼x6½	W	4	1125	239-1800	210-1800	160-1400	13.00	725	80	......	695-1100		......	VI	2.00-.540
25	Buda......*8DCS-1125	Lanova	T,Tr,I	AC	8-5¼x6½	W	4	1125	300-1800	242-1800	184-1400	.....	725	93	......	700-1250		......	VI	2.00-.540
26	Buda...*8DCSM-1125	Lanova	M	AC	8-5¼x6½	W	4	1125	300-1800	260-1800	198-1400	.....	725	100	......	850-1250		......	VI	2.00-.540
27	Caterpillar....D-17000	Own	M,I,R	PC	8-5¾x8	W	4	1662	‡182- 950	174- 950	131- 950	15.5	....	66	61.1♠	1042- 700	8000	9538 (b)	VI	2 5/16-.468
28	Caterpillar....D-13000	Own	Tr,M,R,I	PC	6-5¾x8	W	4	1246	‡150-1000	145-1000	115-1000	15.5	....	73	48.8♠	842- 800	5610	7450 (b)	VI	2 5/16-.468
29	Caterpillar.....D-8800	Own	Tr,M,I	PC	4-5¾x8	W	4	831	‡102-1000	98-1000	79-1000	15.5	....	75	55.7♠	561- 800	4400	5530 (b)	VI	2 5/16-.468
30	Caterpillar.....D-4600	Own	Tr,M,I	PC	6-4¼x5½	W	4	468	‡ 82-1600	78-1600	62-1600	16.5	....	66	48.4♠	300-1100	3000	3780 (b)	VI	1 13/16-.375
31	Caterpillar.....D-4400	Own	Tr,M,I	PC	4-4¼x5½	W	4	312	‡ 55-1600	52-1600	41-1600	16.5	....	65	58.5♠	194-1100	2400	3090 (b)	VI	1 13/16-.375
32	Caterpillar.....D-3400	Own	Tr,M,I	PC	4-3¾x5	W	4	221	‡ 34-1650	32.5-1650	25.2-1650	17.5	....	55	75.0♠	127-1100	1890	2450 (b)	VI	1½-.331
33	Chrysler..........M12	....	M	AC	6-3¾x5	N	4	331	....	82-2400	....	14.75	750	....	82.0	206-1200	....	1745	VI	1.56-.375
34	Climax.........D-148	Own	I,M,GS	PC	2-	W	4	149	22-1200	....	18-1200	16.00	450	80	10.0	97-600	2000	2500	VI	1.75-.422
35	Climax.........D-297	Own	I,M,GS	PC	4-	W	4	298	44-1200	....	36-1200	16.00	450	80	8.0	197-600	3000	3500	VI	1.75-.422
36	Cooper-Bessemer(I)EN	....	M,R,I	DI	8-8x10½	W	4	4222	....	450- 900	400- 900	.....	800	83	40.0	3300- 600	....	16000	VI	3.12-.757
37	Cooper-Bessemer(I)GN	....	M,R,I	DI	8-10½x13½	W	4	9353	....	925- 750	750- 750	.....	750	85	48.0	7400- 450	....	36000	VI	4.00-1.125
38	Cooper-Bessemer.FW6	....	M,R,I	DI	6-9x10½	N	4	4007	....	....	600-1000	.....	1000	118	30.5	....	....	18300	VI	2.50-.718
39	Cooper-Bessemer.FW8	....	M,R,I	DI	8-9x10½	N	4	5342	....	....	800-1000	.....	1000	118	26.0	....	....	20800	VI	2.50-.718
40	Cooper-Bessemer.....	....	M,R,I	DI	12-9x10½	N	4	8014	....	....	1200-1000	.....	1000	118	18.3	....	....	22000	VI	2.50-.718
41	Cooper-Bessemer.....	....	M,R,I	DI	16-9x10½	N	4	10685	....	....	1600-1000	.....	1000	118	17.5	....	....	28000	VI	2.50-.718

(For abbreviations see pages 68 and 69)

Engines—*Concluded*

VALVES				PISTONS				CONNECTING RODS			CRANKSHAFT								CARBURETOR			OVERALL DIMENSIONS (In.)			
Seats													Crank-Pin	MAIN BEARINGS											
															Diameter and Length (In.)										
Angle (Deg.)	Inserts Used?	Insert Material (S.A.E. No.)	Camshaft Drive—Type	Material	Weight with Pins, Rings, Bushings (Oz.)	Piston Pin—Diameter and Length (In.)	Number of Rings per Piston	Material	Center to Center Length (In.)	Weight with Bushing and Cap (Oz.)	Material	Counter Balance Used	Diameter and Length (In.)	Number	Front	Rear	Oil Pressure to—	Spark Plug—Thread Size	Make	Size	Engine Weight without Carburetor or Ignition (Lb.)	Width	Height	Length	Line Number
45	Bo	MI	HG	Al	9.5	.625x2.06	4	1035	6½	16	1045	N	1.62x1.00	2	Timken	Roller	PS	18 mm	Zen	¾	233*	18	19⅜	23 1/16	1
45	Bo	MI	HG	Al	11.5	.625x2.06	4	1035	6½	16	1045	N	1.62x1.00	2	Timken	Roller	PS	18 mm	Zen	¾	233*	18	19⅜	23 1/16	2
45	Bo	MI	HG	Al	16	.750x2.56	4	1035	8⅜	22	1045	N	1.75x1.12	2	Timken	Roller	PS	18 mm	Zen	⅞	285*	21½	25½	25⅜	3
45	Bo	MI	HG	Al	18.2	.750x2.56	4	1035	8⅜	22	1045	N	1.75x1.12	2	Timken	Roller	PS	18 mm	Zen	⅞	285*	21½	25½	25⅜	4
45	Bo	MI	HG	Al	24.5	.937x2.75	4	1035	8⅜	29	1045	N	1.75x1.25	2	Timken	Roller	PS	18 mm	Zen	1	418*	24	25¾	28⅛	5
45	Bo	MI	HG	Al	28	.937x2.75	4	1035	8⅜	29	1045	N	1.75x1.25	2	Timken	Roller	PS	18 mm	Zen	1	418*	24	25¾	28⅛	6
For other engines see SMALL GASOLINE POWER UNITS table																									7

ABBREVIATIONS—Cont.

DC—Durachrome Castings
DFS—Drop Forged Steel
Dia—Diachrome Dp—Duplex
Dur—Duralumin
*—Timing Gears or Chain
E—Used on Exhaust valve seats
(EA)—Engine with Standard Accessories
Ecl—Eclipse f—Accessories drive
Fa—Fire Apparatus
F—In Head and Side ("F" Head)
FA—Fire Apparatus
g—Rocker Arms and Shafts
(h)—Intake 30°, Exhaust 45°
(H)—Horizontal Motor
HC—Helical Gear and Chain
HG—Helical Gear
HH—Horizontal in Head (Valves)
Hol—Holley Carburetor
HS—High Speed Steel
I—In Head (Valves) In—Integral
Ind—Industrial Jad—Jadson 1-S
JM—Jadson 1-S material
(k)—Intake 30°, Exhaust 44°
L—Valves at Side (L-Head)
(m)—2 Engines—8 cylinders each
M—Marine MA—Molybdenum Alloy
MI—Moly Iron
ML—Mechanical Lubricator System
Mo—Molybdenum MS—Manganese Steel
N—No or none NCI—NickelCast Iron
NIS—Nickel Cast Iron, Stellited
NS—Nickel Steel Op—Optional
PS—Pump Splash system
r—Reverse Gear RC—Rail Cars
SA—Special Alloy SB—Spiral Bevel Gear
Sch—Schebler Carburetor
Se—Separate SG—Spur Gear
Sho—Shore Carburetor
Sil—Silcrome Steel
Spec—Special SS—Semi-Steel
St—Stellite Steel
Str—Stromberg Carburetor
t—Tappets and Valve Mechanism
T-12—Thompson Products No. 12
T—Valves, Opposite (T-Head)
T—Trucks TA—Tungsten Alloy
Til—Tilotson Carburetor Tr—Tractors
TS—Tool Steel Tun—Tungsten Steel
W—Wet Liners WA—Wausau Alloy
WR—Wilcox-Rich-EA5
(x)—Sodium Cooled Y—Yes
Zen—Zenith Carburetor
ZC—Zenith or Carter

AND OTHER HEAVY OIL ENGINES

VALVES	PISTONS					PISTON PIN		CONNECTING RODS			MAIN BEARINGS		INJECTION SYSTEM									STARTING METHOD		OVERALL DIMENSIONS			
Exhaust Port Diameter and Lift (In.)	Material	Length (In.)	Weight with Rings and Pin (Lb.)	No. of Compression Rings	No. of Oil Rings	Diameter and Length (In.)	Locked in—	Material (S.A.E. No.)	Center to Center Length (In.)	Weight with Cap and Bushing (Lb.)	Number	Diameter (In.)	Make of Pump	Make of Valve	Valve Type—Open or Closed	Orifices	Pressure—Nozzle Opening (Lb. per Sq. In.)	Air Cleaner—Make	Fuel Filter—Make	Lubricant Filter—Make	Minimum Recommended Cetane Number of Fuel	Make	Type	Length—Fan to Flywheel (In.)	Width (In.)	Height—To Top of Air Cleaner (In.)	Line Number
.96- .390	Alu	4.25	1.20	3	2	.937-2.75	F	X1335	7.56	2.50	2	2.25	AB	AB	C	Pi	1600	Op	AB	Op	45	Op	E-H	20 1/16	20½	36 11/16	1
.96- .390	Alu	4.25	1.20	3	2	.937-2.75	F	X1335	7.56	2.50	4	2.25	AB	AB	C	Pi	1600	Op	AB	Op	45	Op	E-H	31½	23⅝	34 7/16	2
1.18- .486	Alu	4.93	3.00	3	2	1.25-2.92	F	1035	9.50	3.41	5	3.00	AB	AB	C	Pi	2000	Uni	B-P	DeL	46	DR	Ele	33 31/32	25¾	36¼ (12)	3
1.18- .486	Alu	4.93	3.00	3	2	1.25-2.92	F	1035	9.50	3.41	5	3.00	AB	AB	C	Pi	2000	.....	B-P	DeL	46	DR	Ele	46⅞ (11)	26⅞	33⅝ (12)	4
1.18- .486	Alu	4.93	3.36	3	2	1.25-3.06	F	1035	9.50	3.41	5	3.00	AB	AB	C	Pi	2000	Uni	B-P	DeL	46	DR	Ele	33 31/32	25¾	36¼ (12)	5
1.18- .486	Alu	5.06	3.00	3	2	1.25-2.92	F	1035	9.50	3.41	7	3.00	AB	AB	C	Pi	2000	Uni	B-P	DeL	46	DR	Ele	42 11/32	27	35 13/32 (12)	6
1.18- .486	Alu	4.93	3.00	3	2	1.25-2.92	F	1035	9.50	3.41	7	3.00	AB	AB	C	Pi	2000	Uni	B-P	DeL	46	DR	Ele	42 11/32	27	35 13/32 (12)	7
1.18- .486	Alu	4.93	3.00	3	2	1.25-2.92	F	1035	9.50	3.41	7	3.00	AB	AB	C	Pi	2000	Uni	B-P	DeL	46	DR	Ele	42 11/32	27	35 13/32 (12)	8
1.16- .486	Alu	4.93	3.00	3	2	1.25-2.92	F	1035	9.50	3.41	7	3.00	AB	AB	C	Pi	2000	.....	B-P	DeL	46	DR	Ele	54 5/16 (11)	27 11/32	34 5/16 (12)	9
1.31- .476	Alu	5.25	3.84	3	2	1.50-3.18	F	6140	11.00	4.87	7	3.00	AB	AB	C	Pi	2000	Uni	B-P	DeL	46	DR	Ele	48½	25¾	37 5/16 (12)	10
1.37- .476	Alu	5.25	4.48	3	2	1.50-3.56	F	6140	11.00	4.87	7	3.00	AB	AB	C	Pi	2000	Uni	B-P	DeL	46	DR	Ele	48½	25¾	37 5/16 (12)	11
1.37- .476	Alu	5.25	4.48	3	2	1.50-3.56	F	6140	11.00	4.87	7	3.00	AB	AB	C	Pi	2000	.....	B-P	DeL	46	DR	Ele	61 11/32 (11)	29⅞	36⅞ (12)	12
1.78- .540	Alu	8.00	9.30	3	2	2.00-4.37	F	6140	14.25	13.10	7	3.50	AB	AB	C	Pi	2000	.....	P-S	DeL	46	D-N	E-G	88 1/16 (11)	32 11/16	47¾ (12)	13
2.02- .687	Alu	9.31	17.50	3	2	2.75-5.03	F	1035	17.75	28.51	7	4.50	AB	AB	C	Pi	1800	Uni	P-S	DeL	46	D-N	E-G	86 11/16	38 11/32	62 3/16 (12)	14
2.12- .687	Alu	9.31	17.50	3	2	2.75-5.28	F	1035	17.75	28.51	7	4.50	AB	AB	C	Pi	1800	Uni	P-S	DeL	46	D-N	E-G	86 11/16	38 11/32	62 3/16 (12)	15
2.16- .687	Alu	9.31	19.19	3	2	2.75-5.53	F	1035	17.75	28.51	7	4.50	AB	AB	C	Pi	1800	Uni	P-S	DeL	46	D-N	E-G	86 11/16	38 11/32	62 3/16 (12)	16
2.16- .687	Alu	9.31	19.19	3	2	2.75-5.53	F	1035	17.75	28.51	7	4.50	AB	AB	C	Pi	1800	.....	P-S	DeL	46	D-N	E-G	114⅞ (11)	37 1/16	62 7/16 (12)	17
2.16- .687	Alu	9.31	19.19	3	2	2.75-5.53	F	1035	17.75	28.51	7	4.50	AB	AB	C	Pi	1800	Uni	P-S	DeL	46	D-N	E-G	95⅜	48	82 5/16 (12)	18
1.87- .540	Alu	6.75	6.70	3	2	1.75-4.50	F	1040	12.50	10.62	7	3.75	AB	AB	C	Pi	2000	Uni	Com	Com	46	L-D	E-G	58⅛	29 5/16	48¼	*19
1.87- .540	Alu	6.75	6.70	3	2	1.75-4.50	F	1040	12.50	10.62	7	3.75	AB	AB	C	Pi	2000	.....	Com	Com	46	L-D	E-G	83 1/16	30¼	46 1/16	20
1.87- .540	Alu	6.75	6.70	3	2	1.75-4.50	F	1040	12.50	10.62	7	3.75	AB	AB	C	Pi	2000	.....	Com	DeL	46	L-D	E-G	58⅛	32½	48¼	21
1.87- .540	Alu	6.75	6.70	3	2	1.75-4.50	F	1040	12.50	10.62	7	3.75	AB	AB	C	Pi	2000	.....	Com	DeL	46	L-D	E-G	89⅞	36⅛	45½	22
1.87- .540	Alu	6.75	6.70	3	2	1.75-4.50	F	1040	12.50	10.62	9	3.75	AB	AB	C	Pi	2000	.....	Com	DeL	46	L-D	E-G	73	30¼	48¼	23
1.87- .540	Alu	6.75	6.70	3	2	1.75-4.50	F	1040	12.50	10.62	9	3.75	AB	AB	C	Pi	2000	.....	.....	.....	46	L-D	E-G	101¼	36⅛	46 1/16	24
1.87- .540	Alu	6.75	6.70	3	2	1.75-4.50	F	1040	12.50	10.62	9	3.75	AB	AB	C	Pi	2000	.....	.....	.....	46	L-D	E-G	83 11/16	32½	53⅝	25
1.87- .540	Alu	6.75	6.70	3	2	1.75-4.50	F	1040	12.50	10.62	9	3.75	AB	AB	C	Pi	2000	.....	.....	.....	46	L-D	E-G	101¼	36⅛	46 1/16	26
2 1/16- .468	Alu	9.18	.....	4	2	2.37-4.75	F	1045	16.00	.....	5	4.00	Own	Own	C	Si	1750	Don	Own	Pur	35	Own	G	88	49½	66½	27
2 1/16- .468	Alu	9.18	.....	3	1	2.37-4.75	F	1045	15.00	.....	7	3.75	Own	Own	C	Si	1750	Don	Own	Pur	35	Own	G	87½	42¾	60	28
2 1/16- .468	Alu	9.18	.....	3	1	2.37-4.75	F	1045	15.00	.....	5	3.75	Own	Own	C	Si	1750	Don	Own	Pur	35	Own	G	70 5/16	40	58 11/16	29
1 11/16- .375	Alu	6.12	.....	3	2	1.75-3.50	F	1045	10.25	.....	7	3.00	Own	Own	C	Si	1500	Don	Own	Pur	35	Own	G	67 7/16	29⅞	48⅝	30
1 11/16- .375	Alu	6.18	.....	3	2	1.75-3.50	F	1045	10.25	.....	5	3.00	Own	Own	C	Si	1500	Don	Own	Pur	35	Own	G	54	29⅞	45	31
1 11/32- .331	Alu	5.50	.....	3	2	1.56-3.00	F	1045	10.25	.....	5	2.75	Own	Own	C	Si	1500	Don	Own	Pur	35	Own	G	51	26¾	43¾	32
1.31- .375	Alu	5.46	3.25	3	1	1.12-3.25	F	1335	10.43	3.68	7	3.00	Exc	AB	C	Pi	2000	Ind	Pur	Pur	40	AL	Ele	60 7/16	29 11/16	37 11/16	33
1.75- .422	NI	6.12	7.87	4	1	1.75-3.50	F	1045	11.50	6.43	4	3.00	AB	AB	C	Pi	2200	Vor	CB	Nug	45	AL	Ele	46	32	53	34
1.75- .422	NI	6.12	7.87	4	1	1.75-3.50	F	1045	11.50	6.43	6	3.00	AB	AB	C	Pi	2200	Vor	CB	Nug	45	AL	Ele	66	32	53	35
2.65- .757	Alu	14.00	28.75	4	2	3.25-7.00	R	3140	21.00	54.0†	9	6.00	Own	AB	C	Mu	2500	AM	Pur	Cun	....	Own	Air	128½	30½	86	36
3.75-1.125	Alu	17.17	58.00	5	2	4.00-9.37	R	1040	27.00	135.7†	9	7.50	Own	AB	C	Mu	2500	AM	Pur	Cun	....	Own	Air	158½	42¼	83	37
2.50- .718	Alu	10.64	40.3	4	2	3.12-7.50	R	1040	23.25	102.7	8	7.25	Own	AB	C	Mu	2500	AM	Pur	Cun	....	Own	Air	128	61	83	38
2.50- .718	Alu	10.64	55.8	4	2	3.12-7.50	R	1040	23.25	102.7	10	7.25	Own	AB	C	Mu	2500	AM	Pur	Nug	....	Own	Air	159	61	83	39
2.50- .718	Alu	10.64	40.3	4	2	3.12-7.50	R	1040	23.25	167.6	8	7.25	Own	AB	C	Mu	2500	AM	Pur	Cun	....	Own	Air	189⅜	72½	85	40
2.50- .718	Alu	10.64	55.8	4	2	3.12-7.50	R	1040	23.25	167.6	10	7.25	Own	AB	C	Mu	2500	AM	Pur	Nug	....	Own	Air	158⅜	72½	85	41

(For abbreviations see pages 68 and 69)

Automotive Diesel and

Line Number	ENGINE MAKE AND MODEL	Built Under License from	GENERAL: Designed for	Type	Number of Cylinders Bore and Stroke (In.)	Cylinder Liners—Type	Cycle	Piston Displacement (Cu. In.)	With Bare Engine: Maximum Brake Hp. at Specified R.P.M.	With Standard Accessories: Max. Intermittent Hp. at Specified R.P.M.	With Standard Accessories: Continuous Sustained Hp. at Specified R.P.M.	Compression Ratio - to 1	Max. Combustion Pressure (Lb. per Sq. In.)	B.M.E.P. at Continuous Hp. (Lb. per Sq. In.)	Weight per Continuous Hp. (Lb.)	Max. Torque in Lb. Ft. at Specified R.P.M.	Shipping Weight (Lb.): Automotive or Industrial	Shipping Weight (Lb.): Marine	VALVES: Arrangement	VALVES: Intake Port Diameter and Lift (In.)
1	Cummins...........A	Own	T,B,Tr,M,R,I	DI	6-4x5	W	4	377	100-2200■	85-2200■	57-1600■	18.00	750	75	24.2	275-1200	1830	2030	VI	1.37- .406
2	Cummins...........H	Own	T,B,Tr,M,R,I	DI	4-4⅞x6	W	4	448	100-1800■	83-1800	50-1200■	17.00	750	74	32.8	340- 800	1930	3315	VI	1.75- .500
3	Cummins...........H	Own	T,B,Tr,M,R,I	DI	6-4⅞x6	W	4	672	150-1800■	125-1800	85-1400■	17.00	750	72	25.5	500- 800	2540	3670	VI	1.75- .500
4	Cummins........*HS	Own	T,B,Tr,M,R,I	DI	6-4⅞x6	W	4	672	200-1800■	175-1800	120-1400■	14.00	925	101	21.5	625-1400	3000	4040	VI	1.75- .500
5	Cummins.....NH-600	Own	T,B,Tr,M,R,I	DI	6-5⅛x6	W	4	743	200-2100	174-2100	....	15.50	....	....	.....	575-1400	2500	......	...	......
6	Cummins...*NHS-600	Own	T,B,Tr,M,R,I	DI	6-5⅛x6	W	4	743	275-2100	....	....	13.50	....	....	.....	710-1600	3520	......	...	......
7	Fairbanks-Morse (4) 36	Own	M,R,I	TC	6-4¼x6	W	4	510	....	75-1200	60-1200	16.80	800	78	.....	335-1050	....	......	VI	......
8	Fairbanks-Morse (5) 36	Own	M,R,I	TC	6-5½x7½	W	4	1068	....	150-1200	120-1200	14.70	800	74	.....	660-1050	....	......	VI	......
9	Fairbanks-Morse (Oth	er sizes to	2000 hp. avail	able	)															
10	General Motors...2-71	Own	T,B,Tr,M,I,GS	DI	2-4¼x5	D	2	142	....	55-2000	30-1200	16.00	980	70	16.2♭	175-1000	990	Varies	VI	No Valves
11	General Motors...3-71	Own	T,B,Tr,M,I,GS	DI	3-4¼x5	D	2	212	....	83-2000	45-1200	16.00	980	70	13.9	263-1000	1150	Varies	VI	No Values
12	General Motors...4-71	Own	T,B,Tr,M,I,GS	DI	4-4¼x5	D	2	284	....	110-2000	60-1200	16.00	980	70	11.8	350-1000	1300	Varies	VI	No Valves
13	General Motors...6-71	Own	T,B,Tr,M,I,GS	DI	6-4¼x5	D	2	425	....	165-2000	90-1200	16.00	980	70	10.1	525-1000	1600	Varies	VI	No Valves
14	Gray Marine......(7)	G.M.C.	M	DI	6-4¼x5	....	2	425	....	165-2000	120-1800	16.00	980	62	20.2	525-1000	....	2425	VI	No Valves
15	Hercules.......DIXD	Own	Tr,M,I,GS	TC	2-4¼x4½	D	4	127	27.6-1600	23.5-1600	23.5-1600	15.50	750	92	25.9	91-1300	610	610	VI	1.62- .375
16	Hercules.......DOOC	Own	T,Tr,M,I,GS	TC	4-4x4½	D	4	226	70-2600	60-2600	47-1800	15.00	750	91	15.9♭	162-1400	750	......	VI	1.62- .375
17	Hercules.......DOOD	Own	T,Tr,M,I,GS	TC	4-4¼x4½	D	4	255	79-2600	66-2600	53-1800	15.00	750	91	14.2♭	182-1400	750	......	VI	1.62- .375
18	Hercules.......DJXC	Own	T,B,Tr,M,R,I	TC	6-3¾x4½	D	4	298	83-2600	71-2600	59-1800	15.00	750	87	16.1♭	208-1500	950	......	VI	1.62- .375
19	Hercules.......DWXD	Own	T,B,Tr,M,R,I	TC	6-4¼x4¾	D	4	404	135-2600	115-2600	89-1800	14.80	750	97	15.2♭	320-1300	1350	......	VI	1.68- .395
20	Hercules.......DRXB	Own	T,B,Tr,M,R,I	TC	6-4⅜x5¼	D	4	474	132-2200	112-2200	89-1600	14.80	750	94	16.0♭	350-1300	1600	......	VI	2.00- .395
21	Hercules.......DRXC	Own	T,B,Tr,M,R,I	TC	6-4⅝x5¼	D	4	529	147-2200	125-2200	100-1600	14.80	750	94	16.0♭	400-1300	1600	......	VI	2.00- .395
22	Hercules.......DFXD	Own	T,B,M,R,I,GS	TC	6-5½x6	D	4	855	226-2100	192-2100	162-1600	14.80	750	94	15.4♭	680-1200	2500	......	VI	2.37- .500
23	Hercules.......DFXE	Own	T,B,Tr,M,R,I	TC	6-5⅝x6	D	4	895	238-2100	202-2100	170-1600	14.80	750	94	14.7♭	710-1200	2500	......	VI	2.37- .500
24	Hercules.......DEXH	Own	T,B,Tr,M,R,I	TC	6-5¾x6	D	4	935	255-2100	217-2100	178-1600	14.80	750	....	14.5♭	750-1200	2575	......	VI	2.60- .500
25	Hill...............2R	Own	M,I	PC	2-3½x5½	D	4	106	19-1500	17.3-1500	16.6-1500	16.00	....	85	64	69-1200	1225	1300	VI	1.37- .372
26	Hill...............4R	Own	M,I	PC	4-3½x5½	D	4	212	41-1500	36.3-1500	33-1500	16.00	....	85	44	142-1200	....	1750	VI	1.37- .372
27	Hill...............6R	Own	M,I	PC	6-3½x5½	D	4	317	63-1500	55-1500	50-1500	16.00	....	85	37.5	225-1200	....	2300	VI	1.37- .372
28	International.....UD6	Own	Tr,I	PC	4-3⅞x5¼	D	4	248	45-1500	38-1500	31.2-1500	14.20	....	66	40.2♭	185-850	1253	......	VI	1.50- .500
29	International.....UD9	Own	Tr,I	PC	4-4.4x5½	D	4	334	63-1500	53-1500	42.4-1500	14.40	....	67	35.3♭	210-800	1499	......	VI	1.65- .500
30	International....UD14	Own	Tr,I	PC	4-4¾x6½	W	4	461	82-1350	66-1350	54.8-1350	13.67	....	70	32.3♭	303-750	1771	......	VI	1.78- .503
31	International....UD18	Own	Tr,I	PC	6-4¾x6½	W	4	691	119-1400	100-1400	80-1400	13.67	....	65	35.2♭	436-750	2817	......	VI	1.78- .503
32	Kermath..........DIX	Hercules	M	TC	2-4x4½	D	4	113	....	27-1800	20-1800	15.50	750	78	43.5	81-1400	....	870	VI	1.62- .375
33	Kermath.........DOO	Hercules	M	TC	4-4x4½	D	4	226	....	65-2600	49-2600	14.50	500	66	24.5	162-1400	....	1200	VI	1.62- .375
34	Kermath..........DJX	Hercules	M	TC	6-3¾x4½	D	4	298	....	84-2600	63-2600	14.50	500	64	21.5	208-1500	....	1355	VI	1.62- .375
35	Kermath.........DRX	Hercules	M	TC	6-4⅜x5¼	D	4	474	....	113-1800	85-1800	14.50	475	79	24.7	350-1300	....	2100	VI	2.00- .395
36	Kermath.........DHX	Hercules	M	TC	6-5x6	D	4	707	....	160-1600	120-1600	14.50	475	84	26.5	530-1400	....	3182	VI	2.37- .500
37	Murphy.........ME-4	Own	M,I,GS	DI	4-5¾x6½	W	4	675	....	105-1200	90-1200	17.00	....	88	47.0	472- 900	4300	6350	VI	1.62d-.500
38	Murphy.........ME-6	Own	M,I,GS	DI	6-5¾x6½	W	4	1013	....	160-1200	135-1200	17.00	....	88.5	38.5	732- 850	5200	7940	VI	1.62d-.500
39	Murphy.....*ME-650	Own	M,I,GS	DI	6-5¾x6½	W	4	1013	....	200-1200	165-1200	14.00	....	107	37.0	960- 775	5900	8190	VI	1.62d-.500
40	Murphy.......ME-66	Own	M,I,GS	DI	6-6x6½	W	4	1103	....	180-1200	150-1200	17.00	....	90	34.5	8.30- 800	5200	7940	VI	1.62d-.500
41	Murphy.......ME-46	Own	M,I,GS	DI	4-6x6½	W	4	735	....	115-1200	100-1200	17.00	....	90	43.0	5.53- 800	4300	6350	VI	1.62d-.500
42	Red Wing....42-54HP	Wau-Hes	M	DI	4-4x5	W	4	251	55-2200	54-2000	43-1500	5.90	500	65	25.6	155-1000	....	1100	VI	1.62- .445
43	Red Wing....55-60HP	Wau-Hes	M	DI	4-4⅝x5¼	W	4	353	62-1600	59-1600	55-1400	5.60	500	88	21.8	230- 800	....	1200	VI	1.75- .455
44	Red Wing....65-75HP	Wau-Hes	M	DI	6-3¾x4¼	W	4	282	78-2800	75-2800	69-1800	6.40	500	92	22.0	174-1400	....	1300	VI	1.62- .371
45	Red Wing..100-125HP	Wau-Hes	M	DI	6-4½x5½	W	4	525	128-2100	125-2100	106-1500	5.80	500	107	17.0	370-1500	....	1800	VI	1.87- .530
46	Red Wing..160-180HP	Wau-Hes	M	DI	6-6½x7	W	4	1395	174-1125	170-1125	165-1050	5.40	500	89	33.9	900- 500	....	5600	VI	2.50- .710
47	Red Wing..180-200HP	Wau-Hes	M	DI	6-7x7	W	4	1616	200-1125	196-1125	188-1050	5.30	500	87	30.8	1030- 500	....	5800	VI	2.50- .710
48	Scripps 7000A,1A,2A,3A	Hercules	M	TC	4-4¼x4½	D	4	255	79-2600	66-2600	52-1800	14.50	750	90	23.1	185-1400	....	1200	VI	1.62- .375
49	Scripps 8500A,1A,2A,3A	Hercules	M	TC	6-4x4½	D	4	339	103-2600	88-2600	68-1800	14.50	750	88	21.1	238-1500	....	1435	VI	1.62- .375
50	Sterling.........VD6S	....	M,S	....	6-8x9	W	4	2714	....	490-1200	360- 900	14.00	1000	120	19.6	2175-....	8600	9600	VI	2.37- .525
51	Sterling...........VD6	....	M,S	....	6-8x9	W	4	2714	....	325-1200	240- 900	14.00	1000	80	27.7	1425-....	8000	9000	VI	2.37- .525
52	Sterling.........VD8S	....	M,S	....	8-8x9	W	4	3619	....	650-1200	480- 900	14.00	1000	118	16.5	2880-....	9600	10700	VI	2.37- .525
53	Sterling...........VD8	....	M,S	....	8-8x9	W	4	3619	....	440-1200	330- 900	14.00	1000	80	22.9	1922-....	9000	10100	VI	2.37- .525
54	Superior...........A-4	Own	M,I	TC	4-4½x5¾	W	4	366	....	62.5-1500	42-1200	11.80	675	76	44.6	288-1200	....	1875	VI	1.87- .432
55	Superior...........A-6	Own	M,I	TC	6-4½x5¾	W	4	549	....	110-1800	62.5-1200	11.80	675	75	38.4	400-1200	....	2400	VI	1.87- .432
56	Superior...........D-4	Own	M,I	TC	4-5½x7	W	4	665	....	90-1200	63-1000	11.80	750	75	36.0	328-1200	....	3500	VI	2.25- .652
57	Superior...........D-6	Own	M,I	TC	6-5½x7	W	4	998	....	170-1500	114-1200	11.80	750	76	27.3	727-1000	....	4250	VI	2.25- .652
58	Superior...........D-8	Own	M,I	TC	8-5½x7	W	4	1330	....	226-1500	152-1200	11.80	750	75	34.9	985-1000	....	5300	VI	2.25- .652
59	Superior.......P.T.D.	Own	M,I	DI	6-8½x10½	W	4	3575	....	300- 900	240- 720	12.50	750	74	54.2	1750- 900	....	13000	VI	3.12- .875
60	Superior.......P.T.D.	Own	M,I	DI	8-8½x10½	W	4	4767	....	400- 900	320- 720	12.50	750	74	50.0	2000- 900	....	16000	VI	3.12- .875
61	Waukesha..(14) 130HS	Hes	T,Tr,I	DI	4-3¾x5	W	4	221	48-2200	38-2200	28-1500	6.12	500	67	24.6♭	142-1000	695	......	VI	1.62- .445
62	Waukesha..(14) 130HL	Hes	T,Tr,I	DI	4-4x5	W	4	251	55-2200	44-2200	31-1500	5.90	500	65	22.7	155-1000	705	......	VI	1.62- .445
63	Waukesha..(14) VRZH	Hes	T,Tr,I	DI	4-4⅝x5¼	W	4	353	59-1600	47-1600	41-1400	5.60	500	65	25.6♭	229- 700	1050	......	VI	1.75- .450
64	Waukesha..(13) 140HS	Hes	T,B,I	DI	6-4¼x5½	W	4	468	114-2250	95-2250	67-1500	5.80	500	75	22.5♭	342-1000	1510	......	VI	1.87- .531
65	Waukesha..(13) 140HK	Hes	T,B,I	DI	6-4½x5½	W	4	525	128-2250	109-2250	75-1500	5.80	500	74	21.0♭	383-1000	1550	......	VI	1.87- .531
66	Waukesha..(13) 145HK	Hes	T,B,M,I	DI	6-5¼x6	W	4	779	174-2000	148-2000	106-1400	5.60	500	77	17.6♭	550- 900	1865	2900	VI	1.87- .594
67	Waukesha (14) 6WAKH	Hes	T,B,M,R,I	DI	6-6¼x6½	W	4	1197	202-1800	162-1600	139-1300	5.20	500	71	23.0♭	811- 700	3200	3935	VI	2.37- .656
68	Waukesha..(14) 6NKH	Hes	M,I	DI	6-7x8½	W	4	1962	226-1050	187-1050	160- 950	5.42	500	68	38.8♭	1350- 650	6200	7280	VI	2.50- .713
69	Waukesha..(14) 6LRH	Hes	M,R,I	DI	6-8½x8½	W	4	2894	333-1050	277-1050	225- 900	5.43	500	68	47.8♭	1830- 550	10750	9350	VI	3.25- .750

ABBREVIATIONS

■—Without fan or muffler
♭—Based on automotive or industrial weight, ▶ all others on marine
0—With full equipment but without radiator fan
*—Supercharged †—Includes piston pin
††—From center line of crankshaft to top of engine
(1)—Also built in 6 cylinder models
(2)—Fan to flywheel housing
(3)—To top of water outlet (highest point)
(4)—Also built in 1, 2, 3, 4 and 8 cylinder models
(5)—Also built in 8 cylinder model
(6)—Air, electric
(7)—Also built in 1, 2, 3 and 4 cylinder models
(10)—Cast iron to 1600 R.P.M., aluminum above 1600 R.P.M.
(11)—Includes radiator
(12)—From bottom of pan to air cleaner mounting flange
(13)—Automotive power ratings
(14)—Industrial power ratings
A—Air (a)—Aluminum on 1, 2 and 3 cyl.
AB—American Bosch AC—Air chamber
AC—AC Spark Plug Co.
A-E—American Bosch or Ex-Cell-O Corp.
Aft—Aircraft Al—Alloy iron
AL—Electric Auto-Lite Co.
Alu—Aluminum AM—Air-Maze Corp.
AT—Arma Steel, tin plated B—Buses
(b)—Includes reverse and reduction gear
BB—Bendix or Bosch
B-P—Bosch or Purolator
Brg—Briggs Clarifier Co. Bur—Burgess
C—Cars C—Closed Car—Cartridge
CB—Primary, Cuno; Secondary, Bosch.
Cof—Coffman CI—Cast Iron
Com—Commercial Filters Corp.

Other Heavy Oil Engines—*Concluded*

VALVES: Exhaust Port Diameter and Lift (In.)	PISTONS: Material	PISTONS: Length (In.)	PISTONS: Weight with Rings and Pin (Lb.)	PISTONS: No. of Compression Rings	PISTONS: No. of Oil Rings	PISTON PINS: Diameter and Length (In.)	PISTON PINS: Locked In—	CONNECTING RODS: Material (S.A.E. No.)	CONNECTING RODS: Center to Center Length (In.)	CONNECTING RODS: Weight with Cap and Bushing (Lb.)	MAIN BEARINGS: Number	MAIN BEARINGS: Diameter (In.)	INJECTION SYSTEM: Make of Pump	INJECTION SYSTEM: Make of Valve	INJECTION SYSTEM: Valve Type—Open or Closed	INJECTION SYSTEM: Orifices	INJECTION SYSTEM: Pressure—Nozzle Opening (Lb. per Sq. In.)	Air Cleaner—Make	Fuel Filter—Make	Lubricant Filter—Make	Minimum Recommended Cetane Number of Fuel	STARTING METHOD: Make	STARTING METHOD: Type	OVERALL DIMENSIONS: Length—Fan to Flywheel (In.)	OVERALL DIMENSIONS: Width (In.)	OVERALL DIMENSIONS: Height—To Top of Air Cleaner (In.)	Line Number
1.37- .406	CI	5.04	5.70	3	2	1.49-3.37	F	E-4135	9.50	6.6	7	3.87	Own	Own	...	Mu	...	Don	Cun	Nug	50	L-D	Ele	48 5/8 (2)	28 3/8	39 1/16 (3)	1
1.75- .500	CI	6.25	10.56	3	2	1.99-4.09	F	E-4135	12.00	10.2	5	4.50	Own	Own	...	Mu	...	Don	Cun	Nug	50	L-D	Ele	43 7/32 (2)	29 5/8	47 11/32 (3)	2
1.75- .500	CI	6.25	10.56	3	2	1.99-4.09	F	E-4135	12.00	10.2	7	4.50	Own	Own	...	Mu	...	Don	Cun	Nug	50	L-D	Ele	57 7/32 (2)	29 5/8	47 11/32 (3)	3
1.75- .500	Alu	6.25	7.21	3	2	1.99-4.09	F	E-4135	12.00	10.2	7	4.50	Own	Own	...	Mu	...	Don	Cun	Nug	50	L-D	Ele	60 11/32 (2)	30 5/16	47 11/32 (3)	4
...	Alu	6.25	...	3	1	1.99-4.34	F	...	12.00	...	7	4.50	Own	Own	...	Mu	...	Don	...	...	45	L-D	Ele	61 7/32	28 7/8	49 5/16	5
...	Alu	6.25	...	3	1	1.99-4.34	F	...	12.00	...	7	4.50	Own	Own	...	Mu	...	Don	...	...	45	L-D	Ele	60 5/32 (2)	32 5/8	48 11/16	6
...	CI(a)	...	...	...	...	...	...	...	...	...	7	3.00	AB	AB	C	Pi	1700	Op	...	...	50	...	(6)(k)	65	25 3/4	32 7/8††	7
...	CI	...	...	...	...	...	...	...	...	...	8	5.50	AB	AB	C	Pi	1500	Op	...	...	50	...	(6)	79 3/8	29 5/8	39 3/4††	8
																											9
1.25- .385	AT	6.00	7.68	4	2	1.50-3.62	F	1340	10.12	6.16	3	3.50	Own	Own	C	Mu	...	AC	AC	AC	45	DR	Ele	31 1/16	27	36 1/8	10
1.25- .385	AT	6.00	7.68	4	2	1.50-3.62	F	1340	10.12	6.16	4	3.50	Own	Own	C	Mu	...	AC	AC	AC	45	DR	Ele	36	32	48 Max.	11
1.25- .385	AT	6.00	7.68	4	2	1.50-3.62	F	1340	10.12	6.16	5	3.50	Own	Own	C	Mu	...	AC	AC	AC	45	DR	Ele	42	32	48 Max.	12
1.25- .385	AT	6.00	7.68	4	2	1.50-3.62	F	1340	10.12	6.16	7	3.50	Own	Own	C	Mu	...	AC	AC	AC	45	DR	Ele	54	32	48 Max.	13
1.25- .375	AT	6.00	7.00	4	2	1.50-3.62	F	T-1340	10.12	6.12	7	3.50	GM	GM	C	Mu	...	AC	AC	AC	40	DR	Ele	73 3/8	30 5/8	37 1/2	14
1.12- .375	Alu	4.84	4.47	4	2	1.18-3.70	F	CNM	8.00	5.31	2	3.00	AB	AB	C	Pi	1450	...	...	...	45	DR	E-H	27 11/16 (2)	16 5/8	36 1/4	15
1.12- .375	Alu	4.84	4.00	4	2	1.18-3.45	F	CNM	8.00	5.31	5	3.00	AB	AB	C	Pi	1650	...	...	...	45	L-D	E-G	32 1/16 (2)	22 7/8	36	16
1.12- .375	Alu	4.84	4.47	4	2	1.18-3.70	F	CNM	8.00	5.31	5	3.00	AB	AB	C	Pi	1650	...	...	...	45	L-D	E-G	32 1/16 (2)	22 7/8	36	17
1.12- .375	Alu	4.84	3.56	4	2	1.18-3.20	F	CNM	8.00	5.31	7	3.00	AB	AB	C	Pi	1650	...	...	...	45	L-D	E-G	39 (2)	22 5/16	32 1/4	18
1.25- .395	Alu	4.84	4.47	4	2	1.18-3.70	F	CNM	8.50	...	7	3.50	AB	AB	C	Pi	1650	...	...	...	45	L-D	Ele	46 11/32 (2)	25 3/4	36 1/2	19
1.37- .395	Alu	6.84	7.09	4	2	1.62-3.75	F	CNM	9.37	8.59	7	3.50	AB	AB	C	Pi	1650	...	...	...	45	L-D	E-G	46 5/32 (2)	27	38 3/8	20
1.37- .395	Alu	6.84	7.93	4	2	1.62-3.93	F	CNM	9.37	8.59	7	3.50	AB	AB	C	Pi	1650	...	...	...	45	L-D	E-G	46 5/32 (2)	27	38 3/8	21
1.62- .500	Alu	7.53	12.37	4	2	2.00-4.65	F	CNM	12.00	13.75	7	4.50	AB	AB	C	Pi	2000	...	...	...	45	L-D	Ele	62 21/32 (2)	30 5/8	46 5/16	22
1.62- .500	Alu	7.53	12.34	4	2	2.00-4.65	F	CNM	12.00	13.75	7	4.50	AB	AB	C	Pi	2000	...	...	...	45	L-D	Ele	62 21/32 (2)	30 5/8	46 5/16	23
1.90- .500	Alu	7.53	12.6	4	2	2.00-4.90	F	CNM	12.00	13.75	7	4.50	AB	AB	C	Pi	2000	...	...	...	45	L-D	Ele	62 21/32 (2)	30 5/8	48 5/16	24
1.37- .372	Lyn	4.87	2.83	3	2	1.50-2.72	F	4140	13.25	7.3	3	2.93	AB	A-E	C	Pi	1800	Uni	Fram	Brg	...	AL	Ele	35	25	40	25
1.37- .372	Lyn	4.87	2.83	3	2	1.50-2.72	F	4140	13.25	7.3	5	2.93	AB	A-E	C	Pi	1800	Uni	Fram	Brg	...	AL	Ele	47 1/2	25	40	26
1.37- .372	Lyn	4.87	2.83	3	2	1.50-2.72	F	4140	13.25	7.3	7	2.93	AB	A-E	C	Pi	1800	AM	Fram	Brg	...	AL	Ele	58	27	46	27
1.31- .500	Alu	5.70	4.33	3	2	1.31-3.25	F	1040	10.00	8.01	5	3.75	Own	Own	C	Si	700	Don	Pur	Pur	...	Own	Ha	38 1/2	21 3/4	39 5/16	28
1.46- .500	Alu	6.43	6.22	3	2	1.50-3.70	F	1040	11.00	10.83	5	4.12	Own	Own	C	Si	700	Don	Pur	Pur	...	Own	Ha	41 1/2	23 11/16	42 1/2	29
1.53- .503	Alu	6.19	7.27	4	2	1.62-4.10	F	1040	13.25	11.91	5	3.25	Own	Own	C	Si	700	Don	Pur	Pur	...	Own	Ha	47 5/16	27 3/8	45 11/16	30
1.53- .503	Alu	6.19	7.27	4	2	1.62-4.10	F	1040	13.25	11.91	7	3.50	Own	Own	C	Si	700	Don	Pur	Pur	...	Own	Ha	60 11/16	29 1/4	47 5/16	31
1.12- .375	Alu	4.84	4.00	5	1	...	...	CNM	8.00	5.31	2	...	AB	AB	C	Pi	1650	AC	Pur	DeL	...	DR	Ele	41 5/16	23	30 5/8	32
1.12- .375	Alu	4.84	4.00	5	1	...	...	CNM	8.00	5.31	...	...	AB	AB	C	Pi	1650	AC	Pur	Pur	...	DR	Ele	47 3/4	22 1/2	33	33
1.12- .375	Alu	4.84	3.56	5	1	...	...	CNM	8.00	5.31	...	...	AB	AB	C	Pi	1650	AC	Pur	Pur	...	DR	Ele	54 11/16	22 1/2	33	34
1.37- .395	Alu	6.84	7.09	5	1	...	...	CNM	9.37	8.59	...	...	AB	AB	C	Pi	1650	AM	Pur	Pur	...	DR	Ele	60 1/16	27 5/8	37 11/16	35
1.62- .500	Alu	7.53	9.94	5	1	...	...	CNM	12.00	13.00	...	...	AB	AB	C	Pi	1650	AM	Pur	Pur	...	DR	Ele	76 5/8	31	46	36
1.62d-.500	GI	7.75	19.43	4	2	2.12-4.73	F	1035	12.50	14.7	5	4.00	Own	Own	C	Mu	1500	Don	OP	Pur	50	DR	Ele	56 1/16	37	60 11/16	37
1.62d-.500	GI	7.75	19.43	4	2	2.12-4.73	F	1035	12.50	14.7	7	4.00	Own	Own	C	Mu	1500	Don	OP	Pur	50	DR	Ele	73 7/16	37	53 3/4	38
1.62d-.500	GI	7.75	20.5	4	2	2.12-4.73	F	1035	12.50	14.7	7	4.00	Own	Own	C	Mu	1500	Don	OP	Pur	50	DR	Ele	76 5/16	37	51 11/16	39
1.62d-.500	GI	7.75	20.9	4	2	2.12-4.98	F	1035	12.50	14.7	7	4.00	Own	Own	C	Mu	1500	Don	OP	Pur	50	DR	Ele	76 7/16	37	57 1/8	40
1.62d-.500	GI	7.75	20.9	4	2	2.12-4.98	F	1035	12.50	14.7	5	4.00	Own	Own	C	Mu	1500	Don	OP	Pur	50	DR	Ele	56 7/16	37	60 11/16	41
1.25- .453	CI	5.12	4.30	3	1	1.12-3.06	F	1045	8.75	3.56	3	2.62	AB	Hes	O	Mu	1200	...	Mic	Mic	...	DR	Ele	48 5/16	24	33 5/16	42
1.50- .450	CI	5.96	6.00	3	1	1.31-...	F	1045	10.50	5.30	3	2.37	AB	Vik	O	Mu	1200	...	Mic	Mic	60	AL	Ele	52 11/16	21 1/4	38 1/8	43
1.25- .375	Alu	4.87	2.56	3	1	1.00-3.50	F	1045	8.00	3.50	7	2.62	AB	Vik	O	Mu	1200	...	Mic	Mic	60	DR	Ele	53 13/16	23 1/8	31 1/8	44
1.37- .469	Alu	6.50	4.00	3	1	1.37-3.87	F	1045	10.25	5.31	7	3.25	AB	Vik	O	Mu	1200	...	Mic	Mic	60	DR	Ele	78 3/8	29	41 5/16	45
2.25- .710	CI	9.25	20.50	3	1	2.00-5.50	F	1045	15.37	19.60	7	3.75	AB	Vik	O	Mu	1200	Vor	Mic	DeL	60	DR	Ele	100 11/16	30 1/2	56 11/16	46
2.25- .710	CI	9.25	24.75	3	1	2.00-6.00	F	1045	15.37	19.60	7	3.75	AB	Vik	O	Mu	1200	Vor	Mic	DeL	60	DR	Ele	100 11/16	30 1/2	56 11/16	47
1.12- .375	Alu	4.84	4.00	4	2	1.18-3.45	F	CNM	8.00	5.31	5	3.00	AB	AB	C	Pi	1650	AC	Pur	Pur	45	DR	Ele	46 5/8	24 1/4	22 3/4	48
1.12- .375	Alu	4.84	3.56	4	2	1.18-3.20	F	CNM	8.00	5.31	7	3.00	AB	AB	C	Pi	1650	AC	Pur	Pur	45	DR	Ele	53 5/16	24 1/4	22 3/4	49
2.37- .525	Alu	10.25	30.59	4	2	3.00-6.93	F	1040	18.00	46.05	9	6.00	BB	BB	C	...	...	Opt	Opt	Brg	50	LN	Ele	123M	29 1/8	40 7/8	50
2.37- .525	Alu	10.25	30.59	4	2	3.00-6.93	F	1040	18.00	46.05	9	6.00	BB	BB	C	...	...	Opt	Opt	Brg	50	LN	Ele	123M	29 1/8	40 7/8	51
2.37- .525	Alu	10.25	30.59	4	2	3.00-6.93	F	1040	18.00	46.05	9	6.00	BB	BB	C	...	...	Opt	Opt	Brg	50	LN	Ele	145M	29 1/8	40 7/8	52
2.37- .525	Alu	10.25	30.59	4	2	3.00-6.93	F	1040	18.00	46.05	9	6.00	BB	BB	C	...	...	Opt	Opt	Brg	50	LN	Ele	145M	29 1/8	40 7/8	53
1.50- .483	CI	6.68	9.25	4	2	1.75-3.59	F	1040	11.50	8.75	5	3.50	AB	AB	C	Pi	1600	Bur	Pur	Pur	50	LN	Ele	...	...	...	54
1.50- .4[illegible]	(10)	6.68	9.25	4	2	1.75-3.59	F	1040	11.50	8.75	7	3.50	AB	AB	C	Pi	1600	Bur	Pur	Pur	50	LN	Ele	...	...	...	55
1.87- .605	Alu	8.00	6.50	3	2	2.12-4.50	F	1040	14.25	18.00	5	4.50	AB	AB	C	Pi	1600	Bur	Pur	Pur	50	LN	Ele	...	...	...	56
1.87- .605	Alu	8.00	6.50	3	2	2.12-4.50	F	1040	14.25	18.00	7	4.50	AB	AB	C	Pi	1600	Bur	Pur	Pur	50	LN	Ele	...	...	...	57
1.87- .605	Alu	8.00	6.50	3	2	2.12-4.50	F	1040	14.25	18.00	9	4.50	AB	AB	C	Pi	1600	Bur	Pur	Pur	50	LN	Ele	...	...	...	58
3.12- .875	CI	13.78	73.50	4	2	3.53-7.00	F	1045	21.00	75.50	7	6.00	AB	AB	C	Mu	3000	Bur	Bur	Pur	45	...	Air	...	...	...	59
3.12- .875	CI	13.78	73.50	4	2	3.53-7.00	F	1045	21.00	75.50	9	6.00	AB	AB	C	Mu	3000	Bur	Bur	Pur	45	...	Air	...	...	...	60
1.25- .453	CI	5.12	3.60	3	1	1.12-3.06	F	1045	8.75	3.56	3	2.62	AB	Hes	O	Mu	750	Opt	Mic	Mic	...	Opt	E-H	33 5/16	21 1/2	38 3/4	61
1.25- .453	CI	5.12	4.30	3	1	1.12-3.06	F	1045	8.75	3.56	3	2.62	AB	Hes	O	Mu	750	Opt	Mic	Mic	...	Opt	E-H	33 5/16	21 1/2	38 3/4	62
1.50- .450	CI	5.96	6.00	3	1	1.31-4.06	F	1045	10.50	5.31	3	2.37	AB	Hes	O	Mu	750	Opt	Mic	Mic	...	Opt	E-H	39 5/16	25 3/4	34 1/16	63
1.37- .469	Alu	6.50	3.75	3	1	1.37-3.62	F	1045	10.25	5.31	7	3.25	AB	Hes	O	Mu	750	Opt	Mic	Mic	...	Opt	Ele	50 5/8	21 11/16	41 11/16	64
1.37- .469	Alu	6.50	4.00	3	1	1.37-3.87	F	1045	10.25	5.31	7	3.25	AB	Hes	O	Mu	750	Opt	Mic	Mic	...	Opt	Ele	50 5/8	21 11/16	41 11/16	65
1.37- .531	Alu	7.25	6.44	3	1	1.62-4.87	F	1045	11.75	8.31	7	3.50	AB	Hes	O	Mu	750	Opt	Mic	Mic	...	Opt	Ele	55 11/16	25 3/4	46 3/4	66
2.00- .656	CI	8.37	11.00	3	1	1.87-5.50	F	1045	13.25	12.20	7	4.00	AB	Hes	O	Mu	780	Opt	Mic	Mic	...	Opt	E-G	65 5/8	30 5/8	50 7/8	67
2.25- .710	CI	9.25	24.75	3	1	2.00-6.00	F	1045	15.37	19.60	7	3.75	AB	Hes	O	Mu	780	Opt	Mic	HC	...	Opt	E-G	78	32 3/8	57 5/16	68
2.75- .840	CI	11.65	50.00	4	1	2.25-7.75	F	1045	20.87	34.70	7	4.25	AB	Hes	O	Mu	1000	Opt	Mic	Mic	...	Opt	E-G	95 1/8	46 1/2	65 1/16	69

CNM—Chrome-nickel molybdenum
Cun—Cuno Engineering Corp.
(d)—Dual D—Dry liners used
DeL—DeLuxe Products Corp.
DI—Direct injection
D-N—Delco-Remy or Novo
Don—Donaldson Co.
DR—Delco-Remy Div.
E-G—Electric or auxiliary gasoline engine
E-H—Electric or hand Ele—Electric
Exc—Ex-Cell-O Corp. F—Floating
G—Auxiliary gasoline engine, electric optional
GI—Grey Iron Casting
G. M. Corp.—General Motors Corp.
GS—Generating sets
H—Heat Exchanger, marine only
Ha—Hand HC—Honan-Crane Corp.
Hes—Hesselman
HI—Horizontally In-head I—Industrial
Ind—Indiana Wire Cloth Prod. Corp.
(k)—Hand start optional on 1, 2 and 3 cyl.
L-D—Leece Neville or Delco-Remy
LE—Lanova energy cell
LN—Leece Neville Co. Lyn—Lynite
M—Marine Mic—Michiana Products Corp.
N—No or none Mu—Multiple
NI—Nickel Iron Nug—Nugent O—Open
OP—Oilpure Refiner Co. Opt—Optional
P—Piston PC—Precombustion chamber
Pi—Pintle
P-S—Purolator or Stewart-Warner
Pur—Purolator Products, Inc.
R—Railcars R—Locked in Rod
S—Stationary Si—Single
Se—Semi-steel (electric furnace)
T—Trucks TC—Turbulence chamber
Tr—Tractors Uni—United Air Cleaner Div.
VI—Vertically In-head Vik—Viking
Vor—Vortex W—Wet liners used
Wau-Hes—Waukesha-Hesselman

12-Year Record of New Truck Sales, by Makes

(New Truck Registrations by Makes, by Years)*

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941††	1942‡
Autocar	1,748	1,015	1,127	1,139	1,001	1,451	2,181	1,617	2,044	1,955	2,510	319
Brockway	1,685‡	752	875	1,213	1,245	1,695	1,593	1,303	1,818	1,672	2,294	171
Chevrolet	99,600	60,784	99,880	157,507	167,129	204,344	183,674	119,479	169,457	194,038	212,797	11,280
Diamond T	2,483	2,250	4,139	5,440	6,454	8,750	8,118	4,393	5,412	6,358	6,077	530
Divco	......	......	200	254	398	964	1,125	1,229	1,481	1,662	2,306	100
Dodge	13,518	8,744	28,034	48,252	61,488	85,295	64,098	33,656	48,049	54,615	62,925	4,736
Federal	1,523	1,167	1,360	1,962	2,190	2,930	2,339	1,370	1,837	1,617	1,611	175
Ford	138,854	66,937	62,397	128,250	165,848	177,244	189,376	100,959	128,889	162,333	174,024	11,050
F. W. D.	......	......	71	156	212	369	435	274	182	252	280	75
G. M. C.	6,919	6,359	6,602	10,449	11,442	26,980	43,522	20,152	34,908	42,486	45,703	3,429
Hudson	......	......	......	......	638	1,905	4,823	719	409	761	736	33
Indiana	......	957	1,252	729	862	1,705	1,371	435	178		......	......
International	21,073	15,752	26,658	31,555	53,471	71,958	76,174	55,836	66,048	77,691	92,482	7,316
Mack	2,945	1,425	1,652	1,830	1,515	4,226	5,513	4,406	6,670	7,754	9,468	767
Plymouth	......	......	......	......	660	2,420	13,709	6,652	8,294	9,573	7,732	137
Reo	5,166	3,187	3,042	5,035	5,101	4,227	4,254	2,929	853	825	1,543	[illegible]
Sterling	739	227	108	134	174	277	311	267	326	341	400	37
Stewart	1,394	867	684	736	880	1,280	1,148	390	70		......	
Studebaker	3,495	2,430	1,872	1,697	2,100	3,279	5,129	2,000	2,110	1,207	5,078	394
White	2,561	2,138	1,384	3,963	3,304	5,757	5,933	3,514	4,558	7,344	9,271	933
Willys	3,131	1,132	233	25	2,280	2,441	1,122	1,889	1,634	2,291	2,031	98
All Others	7,050	4,290	4,299	3,560	2,291	2,147	2,301	1,880	1,524	1,552	1,429	158
Total	313,884	180,413	245,869	403,886	510,683	611,644	618,249	365,349	486,748	576,327	640,697	41,944‡

‡ Includes Indiana. * Data from R. L. Polk & Co. †† Does not include Federal Government registrations which are included in previous years.
‡ Three months only does not include Connecticut for month of March.

Comparative Record of Retail Sales—Cars and Trucks*

(New Registrations by Months, by Years)

Passenger Cars

	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942‡	1943‡	1944‡	
January	79,821	61,242	136,635	215,775	280,685	145,765	203,212	260,216	297,558	64,603	10,962	9,714	January
February	69,464	94,887	170,615	176,651	215,049	120,359	164,942	224,625	299,701	19,177	11,314	6,933	February
March	78,741	173,287	261,477	301,239	363,738	181,222	248,038	312,371	419,396	29,495	26,694	7,590	March
April	119,909	223,050	319,650	397,186	384,951	192,241	268,335	353,239	488,460	24,338	26,650	8,271	April
May	160,242	219,225	293,199	392,744	391,697	178,052	280,834	345,748	514,478	30,236	25,246	8,360	May
June	174,190	223,864	280,360	369,422	360,236	156,384	243,741	318,615	443,470	23,412	20,576	7,612	June
July	185,660	229,006	285,178	357,490	365,767	148,896	229,308	315,246	391,795	25,594	18,998	5,033	July
August	178,661	193,198	233,851	262,912	306,958	127,954	182,633	211,031	246,595	27,900	17,933	3,808	August
September	157,976	146,931	157,098	208,896	235,683	93,269	141,633	148,000	125,293	19,064	15,447	2,651	September
October	136,326	140,937	148,389	171,397	202,898	119,053	212,586	290,495	165,485	14,120	14,052	2,682	October
November	94,180	107,574	220,262	223,732	196,463	200,853	231,571	301,430	164,747	9,973	12,188	2,697	November
December	58,624	75,356	237,194	327,053	179,621	226,973	246,544	334,073	174,188	32,583	9,523	2,566	December
Total	1,493,794	1,888,557	2,743,908	3,404,497	3,483,752	1,891,021	2,653,377	3,415,905†	3,731,166	320,495‡	209,583‡	67,917‡	Total

Trucks

	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942♦	1943♦	1944♦	
January	11,709	22,903	34,759	43,760	47,618	31,995	37,715	45,650	50,830	23,356	4,627	8,577	January
February	9,707	24,476	34,797	40,301	41,843	27,551	34,102	41,336	50,124	10,311	6,083	6,231	February
March	9,934	33,884	41,511	52,428	60,301	37,255	45,083	53,093	62,413	8,277	8,280	6,726	March
April	17,301	38,882	46,785	64,956	67,832	35,682	46,063	55,982	64,236	17,497	7,019	11,390	April
May	20,925	39,831	47,968	62,183	65,857	32,937	45,381	51,553	64,177	12,473	8,025	14,807	May
June	23,254	34,768	48,243	56,851	58,626	30,647	40,482	43,504	62,265	9,535	7,287	15,263	June
July	30,642	37,490	51,243	63,695	61,686	33,475	44,747	50,913	67,412	9,756	8,474	10,728	July
August	28,799	40,790	50,355	59,222	60,872	34,231	43,523	48,980	56,191	7,615	9,254	18,044	August
September	31,269	37,225	41,390	54,611	54,711	26,570	32,983	39,224	43,892	8,956	8,454	12,386	September
October	28,056	40,878	37,439	41,220	40,246	19,589	37,923	48,356	41,352	8,336	6,473	12,602	October
November	18,691	28,689	36,935	30,255	27,248	23,943	41,286	46,618	36,799	4,854	5,007	12,981	November
December	15,580	24,070	39,258	42,162	31,409	31,474	37,460	51,095	41,006	4,744	2,094	16,730	December
Total	245,869	403,886	510,683	611,644	618,249	365,349	486,748	576,327†	640,697	125,710♦	81,077♦	146,465♦	Total

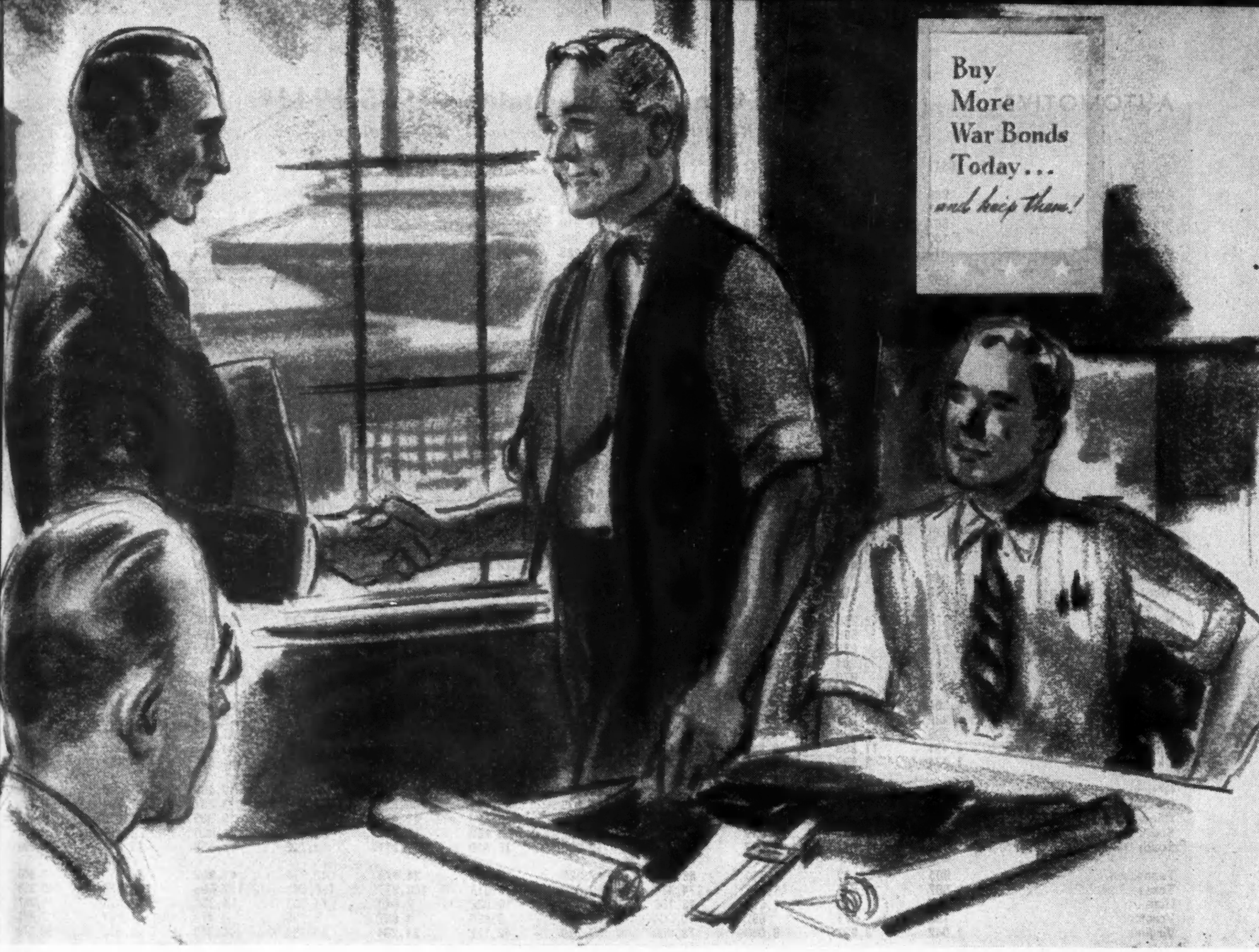
Total Passenger Cars and Trucks

	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	
January	91,530	84,145	171,394	259,535	328,303	177,760	240,927	305,866	348,388	87,959	15,589	18,291	January
February	79,171	119,363	205,412	216,952	256,892	147,910	199,044	265,961	349,825	29,488	17,397	13,164	February
March	88,675	207,171	302,988	353,667	424,039	218,477	293,121	365,464	481,809	37,772	34,974	14,316	March
April	137,210	261,932	366,435	462,142	452,783	227,923	314,398	409,221	552,696	41,835	33,669	19,661	April
May	181,167	259,056	341,167	454,927	457,554	210,989	326,215	397,301	578,655	42,709	33,271	23,167	May
June	197,444	258,632	328,603	426,273	418,862	187,031	284,223	362,119	505,735	32,947	27,863	22,875	June
July	216,302	266,496	336,421	421,185	427,453	182,371	274,055	366,159	459,207	35,350	27,472	15,761	July
August	207,460	233,988	284,206	322,134	367,830	162,185	226,156	260,011	302,786	35,515	27,187	21,852	August
September	189,245	184,156	198,488	263,507	290,394	119,839	174,616	187,224	169,185	28,020	23,901	15,037	September
October	164,384	181,815	185,828	212,617	243,144	138,642	250,509	338,851	206,837	22,456	20,525	15,284	October
November	112,871	136,263	257,197	253,987	223,717	224,796	272,857	348,048	201,546	14,827	17,195	15,678	November
December	74,204	99,426	276,452	369,215	211,030	258,447	284,004	385,168	215,194	37,327	11,617	19,296	December
Total	1,739,663	2,292,443	3,254,591	4,016,141	4,102,001	2,256,370	3,140,125	3,992,232†	4,371,863	446,205	290,660	214,382	Total

*—Figures from R. L. Polk & Co. †—Passenger car total includes 816 delinquent registrations which cannot be assigned to any month. The truck total contains 23 delinquents, making a total car and truck delinquent registration of 839.

‡—First three months of 1942 are new registrations as compiled by R. L. Polk & Co.; remainder of 1942 and entire years of 1943 and 1944 are Deliveries Under Rationing by Office of Price Administration.

♦—First three months of 1942 are new registrations as compiled by R. L. Polk & Co.; remainder of 1942 and entire years of 1943 and 1944 are Commercial Trucks Rationed on Government Exemption Permits and Certificates of Transfer by W.P.B. and O.D.T. It is assumed that all certificates were cashed.



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INLAND SHEETS

Passenger Car Sales by States—1935-1944*

New Car Registrations and Deliveries Under Rationing

	1944†	1943†	1942†	1941	1940	1939	1938	193	1936	1935	Yearly Average 1935-1941
Alabama	986	3,596	3,816	42,453	36,326	30,657	19,427	34,936	35,198	29,407	32,629
Arizona	211	1,011	1,039	11,603	10,943	8,191	6,738	12,562	12,758	9,694	10,355
Arkansas	567	2,497	3,149	23,873	21,916	19,859	12,244	19,793	19,612	17,828	19,303
California	7,150	22,426	16,772	276,649	250,894	187,720	148,011	246,075	256,255	196;967	223,224
Colorado	414	1,705	2,132	28,054	27,668	24,630	17,699	32,505	35,721	26,055	27,476
Connecticut	957	2,352	3,737	64,606	56,621	38,859	28,283	51,268	51,342	40,005	47,020
Delaware	111	544	879	11,371	9,962	7,649	5,429	9,748	8,477	7,119	8,536
District of Columbia	555	1,171	1,842	30,186	29,170	25,637	17,944	28,259	32,787	29,009	27,570
Florida	1,456	3,867	4,250	57,598	55,146	42,462	26,102	43,445	38,988	32,476	42,316
Georgia	1,627	5,069	8,471	59,300	52,400	41,125	25,319	48,823	43,581	38,270	44,116
Idaho	185	797	1,340	13,842	13,120	9,890	6,883	14,139	14,438	11,084	11,913
Illinois	4,275	12,083	24,249	274,142	245,552	193,235	133,914	250,205	236,138	182,202	216,484
Indiana	1,306	5,219	11,314	122,224	113,479	84,494	56,339	123,971	116,280	91,029	101,116
Iowa	578	3,512	4,958	66,508	65,617	59,666	47,489	68,196	71,883	68,955	64,044
Kansas	1,018	3,439	4,471	49,776	46,598	34,687	27,301	56,315	54,094	49,665	45,490
Kentucky	775	2,479	3,462	42,011	38,956	30,806	22,906	41,391	40,109	35,762	35,991
Louisiana	1,599	3,938	3,866	43,504	37,673	32,580	24,842	34,084	37,471	29,279	34,204
Maine	506	1,192	2,079	20,043	19,316	14,204	11,038	20,048	17,890	13,111	16,560
Maryland	1,097	3,105	5,613	56,579	51,319	39,389	27,331	46,371	44,228	41,128	43,763
Massachusetts	2,701	5,678	4,642	125,603	110,599	92,480	63,682	115,603	117,261	85,573	101,543
Michigan	2,943	10,890	21,660	258,733	226,696	163,017	87,184	241,156	226,968	182,604	198,051
Minnesota	1,111	3,946	8,207	77,038	73,653	60,771	52,667	82,874	81,773	65,458	70,604
Mississippi	677	2,435	2,338	26,931	26,747	22,302	13,670	22,646	25,006	19,226	22,361
Missouri	1,384	4,825	10,921	102,684	96,901	76,705	55,543	89,965	87,687	74,915	83,485
Montana	230	894	1,808	17,142	16,697	13,523	10,154	18,062	20,745	17,405	16,246
Nebraska	576	2,238	3,160	32,452	28,935	25,715	22,319	33,640	37,695	34,227	30,712
Nevada	129	566	726	4,398	4,075	3,282	2,576	4,767	5,255	3,547	3,985
New Hampshire	239	535	690	13,270	13,377	10,328	7,062	12,961	12,258	9,988	11,320
New Jersey	2,254	5,284	6,140	134,584	127,347	96,049	70,764	122,103	111,737	86,049	106,947
New Mexico	292	870	743	10,244	10,039	8,315	6,393	10,781	10,881	8,311	9,280
New York	4,304	11,988	17,046	331,730	320,797	264,287	194,049	329,951	303,323	242,505	283,806
North Carolina	936	4,866	5,165	65,727	56,760	46,160	33,922	55,341	49,364	55,990	51,894
North Dakota	209	1,226	1,390	13,621	12,358	9,805	8,620	12,060	11,095	12,612	11,453
Ohio	3,491	11,889	22,984	256,034	233,439	167,526	105,439	250,192	244,865	180,386	205,411
Oklahoma	1,434	3,888	3,351	46,226	45,966	39,627	34,343	51,580	56,605	53,116	46,780
Oregon	550	2,505	3,306	41,558	34,358	25,574	18,769	35,915	40,460	25,749	31,769
Pennsylvania	3,934	10,394	21,685	289,285	274,035	196,201	140,332	293,909	273,281	201,936	238,425
Rhode Island	459	983	1,231	22,337	19,509	16,306	10,483	20,500	19,309	14,810	17,607
South Carolina	482	3,062	2,999	35,611	30,432	25,100	15,748	26,959	24,020	23,419	25,898
South Dakota	158	1,011	1,577	12,451	12,296	10,589	7,911	12,728	13,556	13,531	11,866
Tennessee	905	3,780	4,504	56,115	49,922	37,468	24,973	42,320	41,959	38,447	41,600
Texas	6,587	16,549	13,771	174,314	160,056	132,313	103,817	150,093	157,995	138,726	145,330
Utah	369	1,520	1,612	13,156	12,689	10,038	7,045	14,358	14,398	10,825	11,787
Vermont	138	371	697	10,204	8,792	6,666	4,687	8,799	8,413	7,187	7,821
Virginia	1,042	3,927	6,043	73,808	57,840	42,172	31,204	50,768	50,346	45,813	50,278
Washington	996	3,801	4,468	58,613	46,497	33,316	23,935	49,699	54,458	36,685	43,314
West Virginia	388	1,412	2,748	33,166	31,102	22,955	16,483	35,679	37,272	26,083	28,962
Wisconsin	1,257	3,930	6,751	91,109	83,340	61,873	48,872	97,241	89,569	72,568	77,296
Wyoming	182	542	957	8,700	7,775	7,174	5,136	8,968	9,693	7,170	7,802
Total	65,730‡	205,805‡	290,779‡	3,731,166	3,415,905	2,653,377	1,891,021	3,483,752	3,404,497	2,743,908	3,045,743

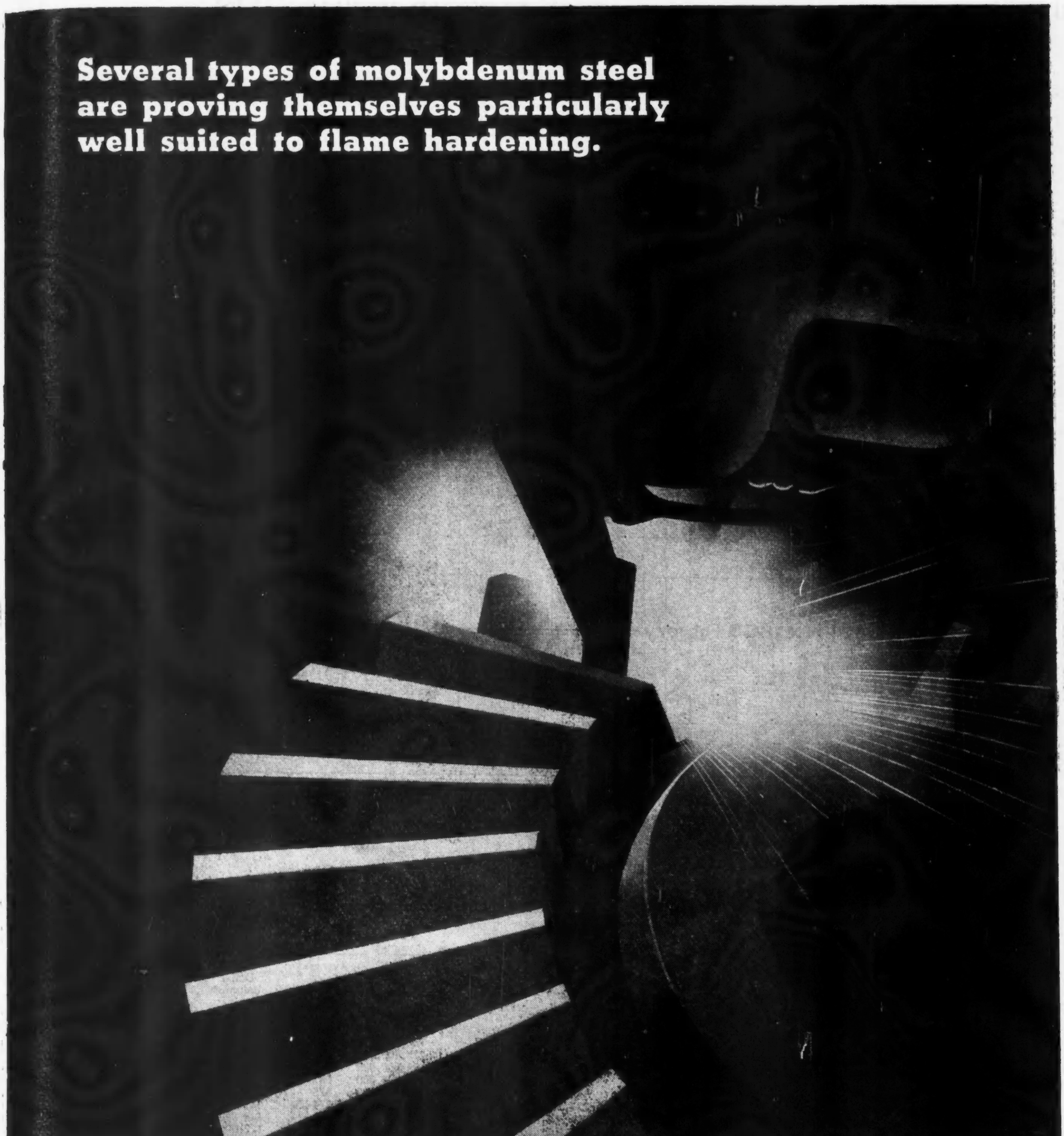
*—R. L. Polk new registrations 1935 through March 1942; April 1942 through December 1944, Deliveries under Rationing by O. P. A.
†—In addition there were 29,716 authorised to Federal Agencies during 1942, 3778 for 1943 and 2187 for 1944. These are not distributed by states.

Tractor Production, 1937-1944

	1944		1943		1942		1941	
	Number	Value	Number	Value	Number	Value	Number	Value
Tractors, all types—Total*	......	....	143,489	$200,515,055	215,074	$208,556,356	358,520	$261,913,833
Wheel type, all kinds—Total	247,376	$168,618,293	105,248	63,784,198	172,123	102,557,627	313,432	182,895,701
With steel tires	......	....	66,272	37,946,049	74,679	43,217,016	14,015	9,120,104
With rubber tires	......	....	38,976	25,838,149	97,444	59,340,611	299,417	173,775,597
Wheel type except "All Purpose"—Total	47,493	39,724,374	16,570	13,413,248	21,135	15,839,902	32,744	24,498,643
With steel tires	......	....	8,788	6,184,515	12,091	8,569,662	7,934	5,704,474
With rubber tires	......	....	7,782	7,228,733	9,044	7,270,240	24,810	18,794,169
Wheel type, "All Purpose"—Total	199,883	128,893,919	88,678	50,370,950	150,988	86,717,725	280,708	158,397,058
With steel tires	......	....	57,484	31,761,534	62,588	34,647,354	6,081	3,415,630
With rubber tires	......	....	31,194	18,609,416	88,400	52,070,371	274,627	154,981,428
Tracklaying type, all sizes—Total	44,760	259,992,480	29,453	135,443,129	29,578	104,123,139	16,497	25,809,630

	1940		1939		1938		1937	
	Number	Value	Number	Value	Number	Value	Number	Value
Tractors, all types—Total*	281,832	$197,273,957	215,462	$157,577,449	199,223	$151,998,349	248,553	$161,261,020
Wheel type, all kinds—Total	249,397	136,796,511	185,558	110,856,746	172,437	116,881,739	237,837	159,685,605
With steel tires	18,308	12,120,195	31,959	19,281,424	61,111	39,547,646	129,291	81,524,710
With rubber tires	231,089	124,676,316	153,599	91,575,322	111,336	77,091,093	108,546	78,160,895
Wheel type except "All Purpose"—Total	25,138	19,815,201	26,973	20,523,664	41,377	33,348,366	53,882	42,384,936
With steel tires	9,618	7,287,364	10,628	7,257,555	21,705	15,831,508	34,494	25,013,421
With rubber tires	15,520	12,527,837	16,345	13,266,109	19,672	17,516,858	19,388	17,371,515
Wheel type, "All Purpose"—Total	224,259	116,981,310	158,585	90,333,082	131,060	83,290,373	183,855	117,300,669
With steel tires	8,690	4,832,831	21,331	12,023,869	39,406	23,716,138	94,797	56,511,289
With rubber tires	215,569	112,148,479	137,254	78,309,213	91,654	59,574,235	89,158	60,789,380
Tracklaying type, all sizes—Total	24,738	59,497,272	20,127	45,305,160	16,837	33,771,693	34,602	66,418,335

* Includes Garden Tractors. Source: Bureau of Census.



CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

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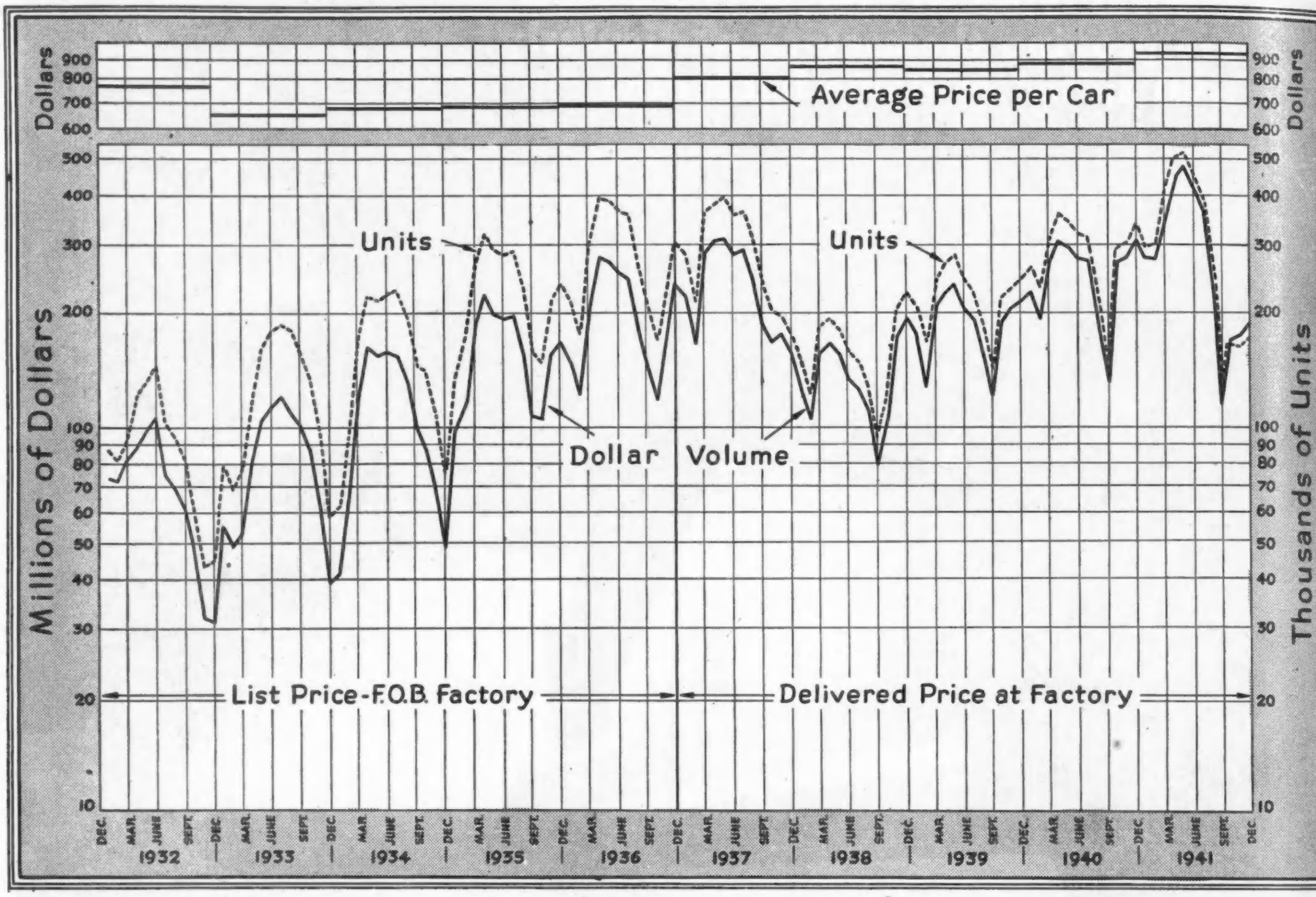
THE RISE AND FALL OF NEW CAR RETAIL SALES

IN TOTAL VALUE AND UNITS SOLD PER MONTH

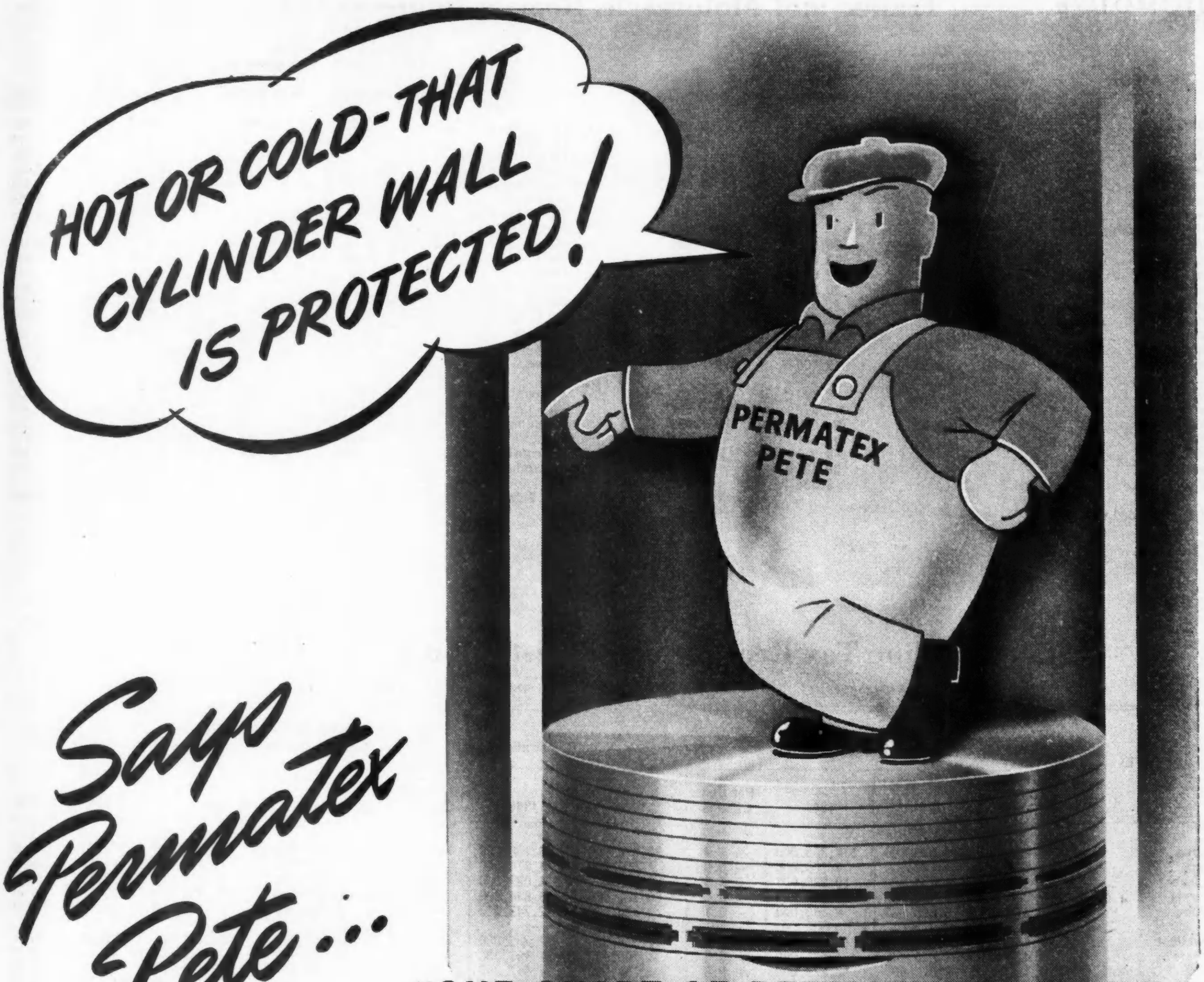


Estimated Dollar Volume of New Car Retail Sales—by Months, by Years

Month	1932 Dollar Volume*	1932 Average Price Per Car	1933 Dollar Volume*	1933 Average Price Per Car	1934 Dollar Volume*	1934 Average Price Per Car	1935 Dollar Volume*	1935 Average Price Per Car	1936 Dollar Volume*	1936 Average Price Per Car	Month
January	$73,700,000	$850	$55,200,000	$693	$43,500,000	$711	$96,400,000	$706	$149,100,000	$691	January
February	72,500,000	878	48,700,000	702	65,200,000	687	119,300,000	700	120,900,000	684	February
March	81,700,000	888	53,900,000	685	120,800,000	697	182,600,000	698	207,900,000	690	March
April	89,600,000	741	80,800,000	675	161,500,000	731	225,400,000	705	275,700,000	694	April
May	98,000,000	753	105,000,000	656	156,800,000	716	199,900,000	682	271,100,000	692	May
June	107,000,000	720	114,000,000	655	158,900,000	711	190,900,000	681	253,500,000	688	June
July	75,000,000	721	120,000,000	647	156,000,000	682	192,500,000	675	244,600,000	686	July
August	68,700,000	737	112,400,000	629	131,100,000	676	157,700,000	674	181,800,000	692	August
September	60,500,000	742	100,100,000	635	99,300,000	676	107,000,000	681	143,800,000	689	September
October	48,300,000	770	86,500,000	635	88,100,000	625	106,700,000	722	122,000,000	713	October
November	33,900,000	772	61,900,000	658	69,800,000	649	152,100,000	692	162,700,000	730	November
December	33,300,000	736	38,500,000	657	47,600,000	631	164,600,000	694	236,900,000	725	December
Total	$842,200,000	$771†	$977,000,000	$655†	$1,298,600,000	$688†	$1,895,100,000	$691†	$2,370,000,000	$697†	Total

Month	1937 Dollar Volume‡	1937 Average Price Per Car	1938 Dollar Volume‡	1938 Average Price Per Car	1939 Dollar Volume‡	1939 Average Price Per Car	1940 Dollar Volume‡	1940 Average Price Per Car	1941 Dollar Volume‡	1941 Average Price Per Car	Month
January	$222,300,000	$768	$126,600,000	$869	$173,200,000	$852	$226,100,000	$869	$276,200,000	$924	January
February	167,800,000	781	104,400,000	868	129,800,000	788	194,300,000	857	275,600,000	918	February
March	286,200,000	787	157,200,000	868	210,400,000	849	269,300,000	862	385,700,000	919	March
April	305,300,000	793	166,800,000	868	226,900,000	846	304,900,000	864	453,000,000	926	April
May	309,900,000	791	154,300,000	866	237,700,000	846	298,100,000	864	476,200,000	925	May
June	285,100,000	792	135,600,000	867	205,600,000	844	274,300,000	862	414,300,000	935	June
July	288,200,000	788	128,400,000	863	192,000,000	837	271,800,000	863	365,200,000	933	July
August	244,600,000	796	110,100,000	860	153,700,000	842	182,600,000	867	227,300,000	922	August
September	187,600,000	809	79,700,000	856	121,900,000	861	131,700,000	893	115,800,000	927	September
October	168,000,000	830	105,700,000	888	188,100,000	885	271,000,000	934	168,600,000	1019	October
November	176,200,000	898	172,300,000	857	204,200,000	882	278,500,000	926	174,300,000	1059	November
December	157,900,000	879	193,200,000	851	216,500,000	878	309,700,000	927	184,700,000	1061	December
Total	$2,799,100,000	$805†	$1,634,300,000	$864†	$2,260,000,000	$852†	$3,012,300,000	$883†	$3,516,900,000	$942†	Total

*—All calculations are based on List Price F. O. B. factory of the five-passenger, four-door sedan, in conjunction with new registrations of each chassis model.
‡—These data not comparable with those of 1932 through 1936 as they are based on "Delivered Price at Factory" rather than "List Price, F. O. B. Factory" used in those years.
†—Average selling price per car for the year.



Says Permatex Pete . . .

"ONE QUART OF PERMATEX TOON-OYL MIXED WITH CRANKCASE OIL PROTECTS AGAINST EXCESSIVE WEAR . . . . *Summer or Winter* "

That cylinder wall and the piston rings "get the works" when the oil is like molasses in cold weather or thin like water in the summer-time.

Permatex Toon-Oyl mixed with any crankcase oil clings to metal surfaces. It protects cylinders from scoring, rings from wearing, valves from sticking and bearings from burning.

Use it in your tune-up work . . . and sell it to your customers.

Send for Permatex Toon-Oyl Manual, *"Three Products in One"* . . . filled with helpful information.

PERMATEX COMPANY, INC. • BROOKLYN 29, NEW YORK

Trailer and Motorcycle Registrations—1944

STATES	TRAILERS: House or Tourist	TRAILERS: Commercial and Semi-trailers	TRAILERS: Total All Trailers	Motorcycles
Alabama	....	....	5,411	2,069
Arizona	....	....	6,000	900
Arkansas	401	12,877	13,278	941
California	37,487	154,185	191,672	22,309
Colorado	....	....	2,188	1,689
Connecticut	6,309	2,467	8,776	2,628
Delaware	(a)	(a)	(a)	320
District of Columbia	....	....	724	488
Florida	11,234	9,678	20,912	3,642
Georgia	8,247	5,251	13,498	2,845
Idaho	12,356	288	12,644	457
Illinois	....	....	26,371	8,381
Indiana	4,000	78,600	82,600	8,900
Iowa	....	....	96,246	2,854
Kansas	....	....	5,890	2,583
Kentucky	(a)	(a)	(a)	1,575
Louisiana	850	12,550	13,400	2,500
Maine	....	....	12,025	850
Maryland	....	....	8,797	2,802
Massachusetts	....	....	19,942	1,815
Michigan	6,613	154,966	161,579	5,559
Minnesota	....	....	42,581	2,870
Mississippi	....	....	8,019	565
Missouri	....	....	38,485	2,761
Montana	....	....	3,334	401
Nebraska	6,065	3,792	9,857	1,455
Nevada	....	....	2,652	170
New Hampshire	....	....	5,727	646
New Jersey	....	....	9,702	5,454
New Mexico	....	....	2,492	479
New York	....	....	56,801	9,916
North Carolina	....	....	47,869	3,280
North Dakota	392	....	392	186
Ohio	....	....	136,815	12,355
Oklahoma	1,053	6,182	7,235	1,939
Oregon	(a)	(a)	(a)	2,149
Pennsylvania	....	....	40,168	11,580
Rhode Island	....	....	1,497	1,163
South Carolina	....	....	3,785	1,870
South Dakota	....	....	22,484	364
Tennessee	....	....	....	2,045
Texas	....	....	44,156	7,129
Utah	....	....	663	511
Vermont	....	....	2,629	391
Virginia	9,947	6,063	16,010	4,062
Washington	....	....	26,920	2,700
West Virginia	3,093	526	3,619	1,011
Wisconsin	944	5,653	6,597	3,656
Wyoming	....	....	8,541	290
Total	108,991	453,078	1,250,983	157,496

(a)—Included with trucks.

State Gasoline Tax Receipts and Registration Fees—1943-1944

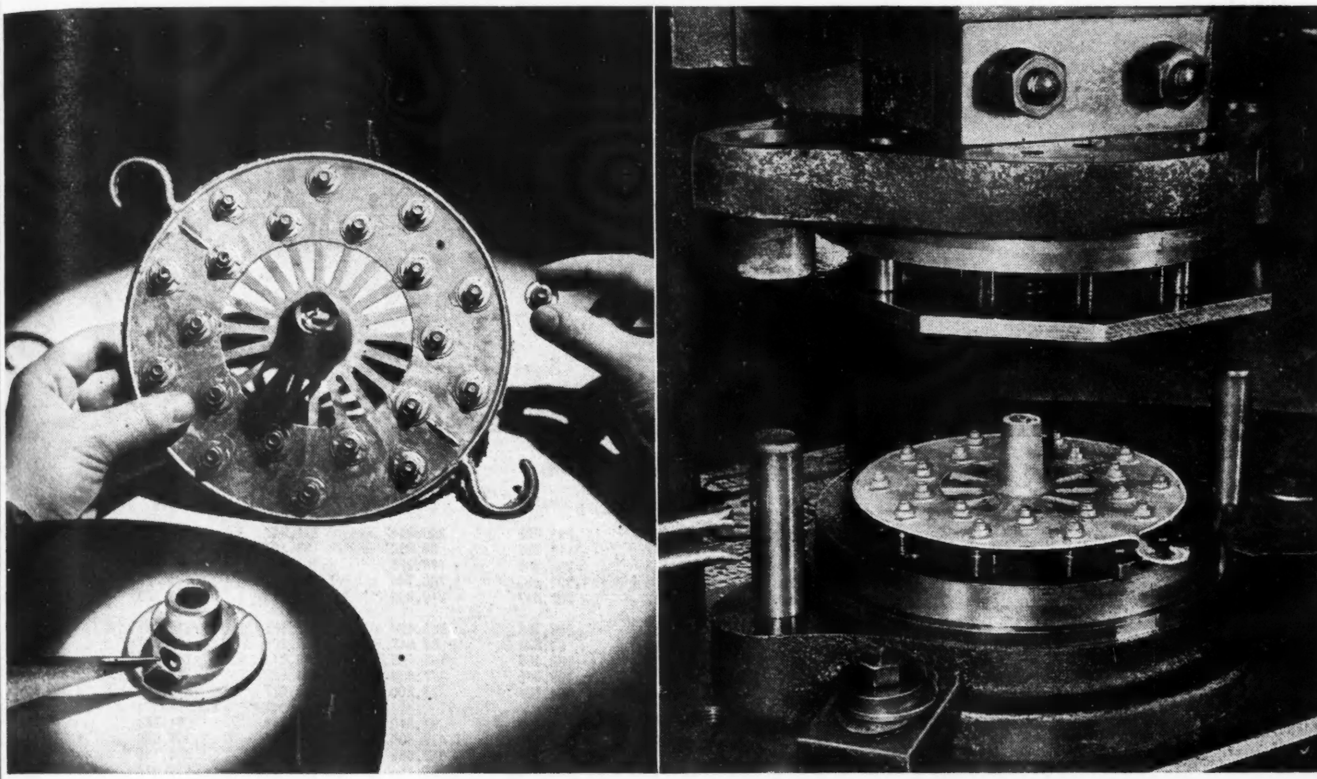
(Exclusive of State or Local Sales Tax or Special Carrier Tax)

STATE	State Tax—Cents per Gallon	State Gasoline Tax Receipts 1944	State Gasoline Tax Receipts 1943	State Gasoline Tax Receipts Per Cent Change	State Registration Fees 1944	State Registration Fees 1943	State Registration Fees Per Cent Change	Total State Tax Receipts from Gasoline and Registration Fees 1944	Total State Tax Receipts from Gasoline and Registration Fees 1943	State Taxes per Motor Vehicle 1944	State Taxes per Motor Vehicle 1943
Alabama	6	$15,036,000	$14,339,000	+ 4.9	$6,000,000	$6,108,000	− 1.8	$21,036,000	$20,447,000	$59.75	$57.50
Arizona	5	4,347,000	4,106,000	+ 5.8	1,300,000	1,378,000	− 5.7	5,647,000	5,484,000	41.17	40.17
Arkansas	6½	10,564,000	10,230,000	+ 3.3	3,476,000	4,027,000	−13.7	14,040,000	14,257,000	52.87	53.29
California	3	45,450,000	43,100,000	+ 5.4	30,351,000	28,824,000	+ 5.2	75,801,000	71,924,000	28.55	27.35
Colorado	4	6,350,000	6,365,000	− 0.3	2,480,000	2,743,000	− 9.6	8,830,000	9,108,000	26.40	26.21
Connecticut	3	6,900,000	6,880,000	+ 0.3	7,098,000	7,232,000	− 1.9	13,998,000	14,112,000	28.63	27.96
Delaware	4	1,614,000	1,531,000	+ 5.4	1,148,000	1,197,000	− 4.1	2,762,000	2,728,000	41.11	39.99
District of Columbia	3	2,896,000	2,877,000	+ 0.6	1,133,000	1,517,000	−25.3	4,029,000	4,394,000	32.14	32.05
Florida	7	21,643,000	20,612,000	+ 5.0	9,850,000	10,153,000	− 3.0	31,493,000	30,765,000	63.53	65.26
Georgia	6	20,232,000	18,182,000	+11.3	3,200,000	2,913,000	+ 9.8	23,432,000	21,095,000	44.48	40.65
Idaho	5.1	3,601,000	3,944,000	− 8.7	1,260,000	1,350,000	− 6.7	4,861,000	5,294,000	32.94	35.21
Illinois	3	28,481,000	29,111,000	− 2.2	22,615,000	23,656,000	− 4.5	57,540,000	52,767,000	33.15	29.08
Indiana	4	19,827,000	19,788,000	+ 0.2	10,000,000	10,543,000	− 5.2	29,827,000	30,331,000	31.78	31.07
Iowa	3	11,021,000	10,544,000	+ 4.5	11,947,000	13,064,000	− 8.6	22,968,000	23,608,000	33.09	32.89
Kansas	3	8,442,000	8,058,000	+ 4.8	4,275,000	4,666,000	− 8.4	12,717,000	12,724,000	21.24	20.97
Kentucky	5	12,310,000	12,193,000	+ 0.9	3,750,000	4,433,000	−15.5	16,060,000	16,626,000	36.89	37.88
Louisiana	7	17,472,000	16,325,000	+ 7.0	3,342,000	3,323,000	+ 0.5	20,814,000	19,648,000	54.32	50.57
Maine	4	4,279,000	3,919,000	+ 9.2	3,953,000	3,862,000	+ 2.3	8,232,000	7,781,000	43.04	41.45
Maryland	4	9,573,000	9,057,000	+ 5.7	5,607,000	5,802,000	− 3.4	15,180,000	14,859,000	33.42	31.92
Massachusetts	3	13,076,000	13,095,000	− 0.2	6,793,000	6,818,000	− 0.4	19,869,000	19,913,000	24.00	24.07
Michigan	3	23,333,000	23,193,000	+ 0.6	23,270,000	23,548,000	− 1.2	46,603,000	46,741,000	32.01	30.42
Minnesota	4	14,178,000	13,390,000	+ 5.9	8,019,000	8,450,000	− 5.2	22,197,000	21,840,000	29.27	27.70
Mississippi	6	10,536,000	9,986,000	+ 5.5	2,900,000	2,866,000	+ 1.1	13,436,000	12,852,000	54.35	51.53
Missouri	2	9,438,000	9,802,000	− 3.7	10,220,000	10,052,000	+ 1.6	19,658,000	19,854,000	23.51	22.94
Montana	5	3,786,000	3,601,000	+ 5.1	1,250,000	1,388,000	−10.0	5,036,000	4,989,000	32.00	31.02
Nebraska	5	10,212,000	10,009,000	+ 2.0	2,888,000	3,109,000	− 7.2	13,100,000	13,118,000	32.80	32.19
Nevada	4	1,002,000	1,210,000	−17.2	400,000	440,000	− 9.1	1,402,000	1,650,000	29.68	32.73
New Hampshire	4	2,100,000	1,955,000	+ 7.4	2,500,000	2,580,000	− 3.2	4,600,000	4,535,000	38.98	40.60
New Jersey	3	15,342,000	14,488,000	+ 5.8	19,831,000	20,189,000	− 1.8	35,173,000	34,677,000	35.52	33.54
New Mexico	5	3,755,000	3,392,000	+10.7	1,485,000	1,690,000	−12.2	5,240,000	5,082,000	46.99	43.79
New York	4	43,194,000	42,926,000	+ 0.6	43,661,000	47,391,000	− 7.9	86,855,000	90,317,000	38.99	39.30
North Carolina	6	21,297,000	20,336,000	+ 4.7	10,904,000	9,093,000	+19.9	32,201,000	29,429,000	50.25	48.86
North Dakota	4	2,584,000	2,435,000	+ 6.1	1,682,000	1,924,000	−12.6	4,266,000	4,359,000	23.63	24.28
Ohio	4	39,357,000	41,443,000	− 5.0	29,000,000	30,557,000	− 5.1	68,357,000	72,000,000	37.02	36.62
Oklahoma	5½	15,803,000	14,947,000	+ 5.7	7,654,000	7,904,000	− 3.2	23,457,000	22,851,000	47.23	44.77
Oregon	5	9,634,000	9,630,000	.....	3,755,000	3,747,000	+ 0.2	13,389,000	13,377,000	32.60	32.75
Pennsylvania	4	45,514,000	43,450,000	+ 4.8	31,750,000	32,400,000	− 2.1	77,264,000	75,850,000	40.69	37.76
Rhode Island	3	2,622,000	2,585,000	+ 1.4	2,975,000	2,974,000	.....	5,597,000	5,559,000	32.18	30.38
South Carolina	6	11,349,000	10,526,000	+ 7.8	2,271,000	2,224,000	+ 2.1	13,620,000	12,750,000	41.89	38.09
South Dakota	4	3,644,000	3,596,000	+ 1.3	1,371,000	1,568,000	−12.6	5,015,000	5,164,000	28.10	28.32
Tennessee	7	20,747,000	19,920,000	+ 4.1	6,150,000	6,395,000	− 3.9	26,897,000	26,315,000	60.34	58.73
Texas	4	39,928,000	37,631,000	+ 6.1	23,694,000	24,602,000	− 3.7	63,622,000	62,233,000	40.95	39.90
Utah	4	3,854,000	3,892,000	− 1.0	1,402,000	1,413,000	− 0.8	5,256,000	5,305,000	34.27	33.52
Vermont	4	1,779,000	1,620,000	+ 9.8	2,279,000	2,192,000	+ 3.9	4,058,000	3,812,000	47.70	46.68
Virginia	5	16,152,000	15,279,000	+ 5.7	7,758,000	7,674,000	+ 1.0	23,910,000	22,953,000	46.23	45.20
Washington	5	15,204,000	14,998,000	+ 1.4	5,247,000	5,284,000	− 0.8	20,451,000	20,282,000	33.89	34.00
West Virginia	5	7,673,000	7,264,000	+ 5.6	5,450,000	5,582,000	− 2.4	13,123,000	12,846,000	51.37	49.86
Wisconsin	4	16,290,000	15,046,000	+ 8.3	13,328,000	13,540,000	− 1.6	29,618,000	28,586,000	35.75	34.40
Wyoming	4	2,178,000	2,049,000	+ 6.2	646,000	637,000	+ 1.4	2,824,000	2,686,000	34.21	32.49
Total		$675,600,000	$654,855,000	+ 3.2	$413,318,000	$425,022,000	− 2.8	$1,095,362,000	$1,079,877,000	$36.66†	$35.41†

†—U. S. Average per vehicle.

SHORT CUTS!

—MACHINING PROBLEMS SIMPLIFIED WITH ZINC ALLOY DIE CASTINGS



Zinc alloy die castings are often produced so close to finished dimensions that little or no machining is required. When machining *is* called for, however, the free-cutting zinc alloys insure easy, rapid metal removal —with long tool life.

This short-cut factor is illustrated in the high speed production of a shell fuse casting (see inset in photograph directly above.) 20 of these fuse parts are cast on a circular gate in one shot—and this gate has hooks cast on its outer edge for ease of conveying from the casting machine. Two locating pins are also cast on the underside of the gate for accurate and rapid positioning in a trimming die (right) where, in one punch, the 20 individual fuse castings are removed. The remaining gate is remelted and reused.

The free-cutting quality of zinc alloys facilitates the subsequent drilling of a hole (see inset) in each casting and thus, **in just three operations—casting, trimming and drilling—the vitally needed shell fuse castings are rapidly produced.** It is the combination of high speed production and excellent physical characteristics which have made die castings of zinc alloy the most widely used. *Every die casting company is equipped to make zinc alloy die castings,* and will be glad to discuss their advantages with you—or write to The New Jersey Zinc Company, 160 Front Street, New York 7, N. Y.

ZINC

FOR DIE CASTING ALLOYS

The Research was done, the Alloys were developed, and most Die Castings are specified with

HORSE HEAD SPECIAL (99.99+% Uniform Quality) ZINC

Production and Stocks of Major Refined Petroleum Products, 1937-1944

(Thousands of Barrels)

	1937	1938	1939	1940	1941	1942	1943†	1944†
MOTOR FUEL								
Production	571,727	569,162	611,043	616,695	701,294	608,900	553,336	677,684
Stocks, end of period	74,650	70,779	81,722	83,647	90,596	75,404	64,499	72,441
Finished Gasoline	....	65,949	77,301	77,943	86,159	70,772	59,854	68,107
Natural Gasoline	....	4,830	4,421	5,704	4,437	4,632	4,645	4,334
KEROSENE								
Production	65,308	64,580	68,521	73,882	72,586	67,474	65,745	71,883
Stocks, end of period	7,083	7,799	7,576	9,512	14,515	10,064	6,223	6,977
DISTILLATE FUEL OIL								
Production	146,706	151,774	161,746	183,304	189,177	196,714	191,585	220,094
Stocks	22,566	36,224	33,718	42,940	49,330	44,920	44,806	45,584
RESIDUAL FUEL OIL								
Production	312,064	294,890	305,944	316,221	342,367	358,901	379,344	420,187
Stocks, end of period	81,507	101,971	92,290	89,304	82,959	61,783	53,046	55,643
LUBRICATING OIL								
Production	35,321	30,826	35,036	36,765	39,539	38,626	35,462	37,525
Stocks	7,512	7,695	7,142	8,767	8,127	9,424	7,770	7,562

Source—Bureau of Mines. †—11 Months.

Highway Use of Motor-Fuel, by States, by Years*

(Thousands of gallons)

	1944†	1943	1942	1941	1940	1939	1938	1937
Alabama	236,083	224,683	275,995	296,525	250,234	231,947	218,145	210,683
Arizona	91,060	86,252	106,017	113,582	99,998	93,107	89,361	86,396
Arkansas	160,199	151,300	185,113	206,509	178,275	168,800	155,253	149,880
California	1,515,991	1,438,783	1,700,434	1,991,690	1,766,144	1,688,317	1,584,268	1,561,258
Colorado	170,317	162,206	202,512	227,617	210,964	200,713	192,325	184,801
Connecticut	236,083	224,632	304,947	399,253	365,429	337,665	315,881	313,528
Delaware	42,158	39,228	49,328	64,233	59,647	55,101	53,737	50,878
District of Columbia	102,865	97,122	135,321	182,306	165,195	146,213	137,371	131,080
Florida	290,045	275,511	301,661	409,045	377,489	339,523	317,140	302,640
Georgia	298,476	282,739	324,259	406,781	374,300	339,877	319,252	308,681
Idaho	82,629	78,633	90,494	104,363	97,510	91,343	84,318	80,570
Illinois	1,067,433	1,013,955	1,288,486	1,540,510	1,419,805	1,337,895	1,260,850	1,217,974
Indiana	470,480	446,115	633,525	734,810	642,589	599,379	564,739	570,188
Iowa	384,478	365,142	448,933	530,413	490,454	473,176	450,012	429,590
Kansas	291,731	276,997	332,367	382,283	349,282	336,807	338,824	333,498
Kentucky	224,279	212,447	260,147	320,251	283,830	267,507	248,287	238,940
Louisiana	232,710	220,673	244,745	289,835	249,757	233,424	221,847	221,204
Maine	102,865	97,011	121,633	164,352	150,002	143,103	137,884	137,649
Maryland	237,769	226,469	277,247	334,953	294,208	271,938	252,179	248,128
Massachusetts	460,362	436,281	558,566	758,390	716,216	687,616	661,782	664,561
Michigan	849,899	806,233	1,035,390	1,233,199	1,101,900	1,021,694	930,331	972,939
Minnesota	360,869	342,655	460,893	532,422	498,617	471,882	450,917	433,143
Mississippi	178,749	169,582	202,130	233,881	200,565	191,363	173,341	167,175
Missouri	514,324	488,727	619,294	752,416	664,044	625,882	583,100	566,614
Montana	79,256	75,287	94,319	117,731	109,723	103,906	93,489	90,983
Nebraska	188,866	179,375	208,450	227,308	211,823	211,375	203,212	199,329
Nevada	32,040	31,047	41,155	43,753	38,694	35,583	31,653	30,203
New Hampshire	52,275	50,049	66,820	96,145	91,413	89,259	83,772	82,807
New Jersey	561,541	533,079	716,574	921,921	869,669	820,352	788,287	761,841
New Mexico	72,511	69,392	86,097	106,000	96,903	89,124	84,747	79,800
New York	1,168,612	1,108,392	1,469,164	1,943,763	1,876,170	1,806,041	1,738,582	1,702,621
North Carolina	364,243	345,340	390,547	515,535	444,953	413,573	389,054	373,317
North Dakota	67,452	63,736	85,633	90,112	85,779	83,678	89,681	88,647
Ohio	1,085,983	1,029,944	1,273,114	1,475,087	1,323,196	1,234,000	1,157,801	1,167,989
Oklahoma	284,986	270,520	321,000	394,608	382,228	369,582	362,897	344,027
Oregon	207,416	197,603	231,315	266,823	235,787	218,102	203,354	196,127
Pennsylvania	1,015,158	963,566	1,259,615	1,621,781	1,517,775	1,422,004	1,346,552	1,353,491
Rhode Island	87,688	82,960	112,337	141,334	132,074	127,714	118,325	118,644
South Carolina	178,749	169,843	196,044	253,345	220,359	199,422	181,485	173,360
South Dakota	101,178	96,174	106,944	122,296	114,953	104,624	103,623	97,347
Tennessee	300,163	285,214	324,133	352,431	300,562	268,102	259,484	237,540
Texas	1,018,530	967,018	1,152,508	1,347,632	1,204,397	1,146,784	1,083,851	1,041,463
Utah	99,492	94,113	103,744	110,892	101,218	94,482	85,435	75,720
Vermont	40,471	38,712	51,627	72,061	68,661	65,948	62,329	61,887
Virginia	327,144	310,635	376,263	477,573	400,159	365,722	341,082	322,667
Washington	323,771	306,608	356,928	395,111	356,828	327,940	314,359	305,082
West Virginia	153,454	145,233	190,255	235,457	216,629	213,281	188,401	192,079
Wisconsin	406,400	385,293	515,539	584,624	532,770	510,822	488,209	484,315
Wyoming	43,844	41,741	50,323	69,455	62,179	59,428	57,436	55,049
Total	16,863,077†	16,004,250	19,939,887	24,192,397	22,001,356	20,735,120	19,598,244	19,218,121
Per Cent Change	+5.36%	−19.74%	−17.58%	+9.95%	+6.10%	+5.80%	+1.97%	+7.63%
Total U. S. Consumption‡	24,795,000†	21,807,227	23,664,250	26,775,262	24,125,627	22,678,474	21,418,572	21,231,618
Highway Use as % of Total	68.00%	73.38%	84.26%	90.35%	91.19%	91.43%	91.50%	90.51%

*—Public Roads Administration, Federal Works Agency. †—Estimated by Automotive and Aviation Industries. ‡—American Petroleum Institute.

Here's Your 3-step plan for

BETTER TOOLS TO CUT PRODUCTION COSTS

Use this sure way to knock the props from under production costs. Let Carpenter help you put this three-step plan to work in your tool room and heat treating department. With it you can reduce machine down-time and actually lower unit costs.

1. *Cut The Cost Of Tooling-Up And Reduce Machine Shut-Downs!*

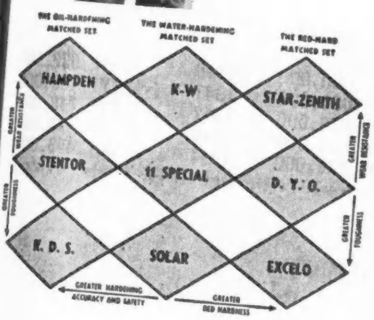
It's no trick at all to make sure of selecting the proper tool steel for each job when you use the Carpenter Matched Set Method. Many plants use this method of selection to lick production problems caused by premature tool and die failure. And it works! Now tool makers who have used it are relying on it to get *every* job done right. They know it cuts the cost of tooling-up and reduces machine shut-down time. And those savings are bound to show up in the cost of the finished product.

2. *Insurance That Each Tool Will Pay-Off On The Job!*

As you know, proper heat treatment is the second step to seeing that each tool is made to do its job right. And the Carpenter Heat Treating Guide quickly gives you this important information about each Carpenter Matched Tool Steel: Type analysis, Forging heat, Normalizing heat, Annealing treatment, Hardening treatment and Recommended drawing range. And this slide chart gives you tips on quenching, oxidizing atmospheres, heating time and heating speed for drawing. For your free copy, drop us a note on your company letterhead.

3. *Check On Tool Life And Output Per Grind!*

Find out which tools and dies need too frequent regrinding or fail prematurely in service. Carpenter Matched Tool Steels can help you lick this condition, and reduce unit costs. And for personal help in your tool room or heat treating department, get in touch with your nearby Carpenter representative. He knows tool steel inside-out, and can often provide the kind of engineering help that licks tough production bugs.



How the Carpenter Matched Set Method Helps to Solve Your Tool Steel Problems...

These are really Matched Tool Steels, as one picks up its job where the other "leaves off."

The key steel is the one in the center, *No. 11 Special*, a straight carbon, tough timbre, water-hardening tool steel. When you have a tool to make, you first find out if it can be made from *No. 11 Special*. If the answer is "Yes", you go no further. But when the answer is "No", you use the diagram to point the way to the tool steel that will do the job. For greater *wear resistance* you go north. For greater *hardening accuracy and safety*, you move west, etc.

To learn more about the ways this method can be used in solving *your* special problems, ask for a copy of the 167-page Carpenter Matched Tool Steel Manual. It contains an 80-page tool index and steel selector that many tool engineers find extremely handy. For your copy, write us a note on your company letterhead, indicating your title. (Free in U. S. A.)

The Carpenter Steel Co., 103 W. Bern St., Reading, Pa.

Carpenter
MATCHED
TOOL STEELS

MACHINE TOOLS

New Orders, Shipments and Unfilled Orders, by Months, 1942-1944

(Thousands of Dollars)

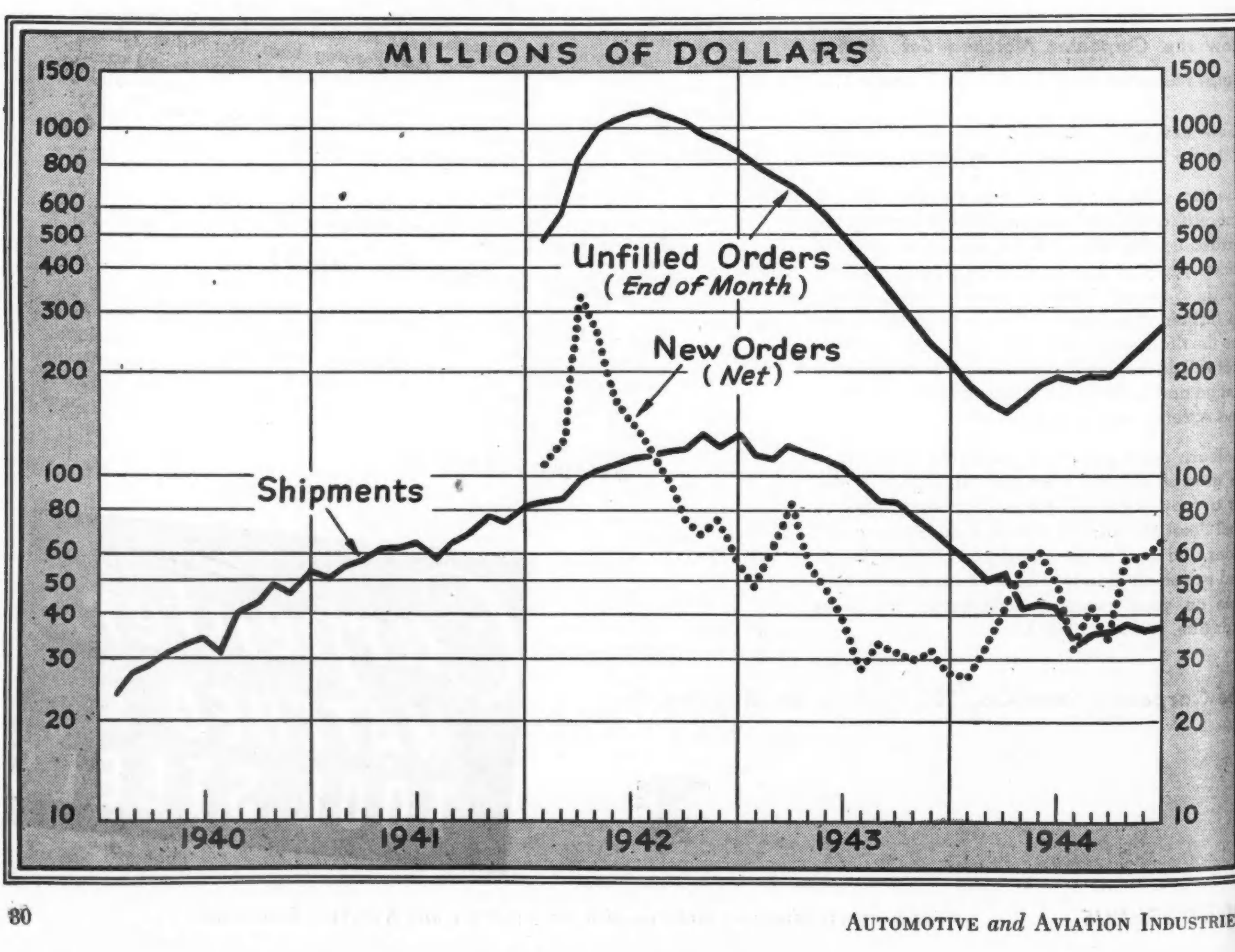
Month	1942 New Orders, Net	1942 Shipments	1942 Unfilled Orders, End-of-Month	1943 New Orders, Net	1943 Shipments	1943 Unfilled Orders, End-of-Month	1944 New Orders, Net	1944 Shipments	1944 Unfilled Orders, End-of-Month
January	$107,500	$83,547	$488,359	$48,829	$117,384	$796,101	$26,457	$56,363	$181,538
February	127,356	84,432	582,245	63,865	114,593	745,830	33,419	50,127	164,536
March	338,334	98,358	843,543	84,980	125,445	704,922	40,950	51,907	153,563
April	254,274	103,364	995,623	57,331	118,024	643,586	55,247	41,370	167,232
May	166,945	107,297	1,059,797	48,241	113,859	578,447	59,922	41,819	185,746
June	139,397	111,090	1,096,447	39,026	108,736	509,259	49,558	41,471	194,450
July	121,156	113,596	1,117,391	28,713	97,541	441,220	31,889	32,753	191,295
August	96,979	117,342	1,096,009	33,524	87,805	386,798	41,079	35,177	196,760
September	74,343	119,883	1,050,699	31,759	85,842	333,119	33,152	35,889	194,125
October	66,474	130,008	986,658	30,836	78,302	286,622	57,206	37,516	213,675
November	76,116	120,871	941,834	31,554	71,851	244,215	58,706	36,277	235,396
December	56,083	131,960	866,578	27,604	60,861	210,606	62,504	36,784	260,880
Monthly Average	$135,413	$110,146	$927,099	$43,855	$98,353	$490,060	$45,841	$41,454	$194,933

Yearly Dollar Volume of Machine Tool Shipments

1920	$124,000,000	1925	$91,500,000	1930	$96,000,000	1935	$85,000,000	1940	$442,632,000
1921	23,000,000	1926	105,000,000	1931	51,000,000	1936	133,000,000	1941	771,465,000
1922	46,700,000	1927	87,000,000	1932	22,000,000	1937	189,088,000	1942	1,321,748,000
1923	82,000,000	1928	128,000,000	1933	25,000,000	1938	140,521,000	1943	1,180,243,000
1924	57,400,000	1929	185,000,000	1934	50,000,000	1939	199,949,000	1944	497,453,000

Source: 1921-1941 inclusive from reports of National Machine Tool Builders Association. For years 1942 through 1944, Tools Division of W.P.B.

DOLLAR VOLUME OF MACHINE TOOL SHIPMENTS NEW ORDERS AND UNFILLED ORDERS



Lend-Lease Exports of Automotive and Aviation Products

March, 1941 Through November, 1944

(Thousands of Dollars)

	United Kingdom	U. S. S. R.	Middle East	Australia and New Zealand	China and India	Latin America	Total All Countries
AIRCRAFT AND PARTS							
1941	$13,330	....	$2,022	$6,998	$36	$363	$22,749
1942	275,752	$303,396	114,590	44,128	17,949	17,798	773,613
1943	606,100	502,007	290,286	122,588	167,714‡	33,189	1,721,884
1944*	1,020,931	525,733	374,672	110,571	312,953	35,232	2,380,092
TANKS AND PARTS							
1941	$10,521	$35	$41,330†	$454	$1,480	....	$53,820
1942	35,998	176,804	164,463†	40,311	59,843	$10,549†	487,968
1943	473,830	74,734	564,447†	13,781	36,828‡	26,332†	1,189,952
1944*	463,260	145,776	174,533	793	20,915	7,755	813,032
MOTOR VEHICLES AND PARTS							
1941	$14,559	....	....	$341	$7,467	....	$22,367
1942	61,950	$149,092	....	28,752	39,603	....	279,397
1943	185,282	406,004	....	103,332	109,243‡	....	803,861
1944*	326,630	458,854	$121,976	45,660	105,214	$6,691	1,065,025
TOTAL AUTOMOTIVE AND AVIATION PRODUCTS							
1941	$38,410	$35	$43,352	$7,793	$8,983	$363	$98,936
1942	373,700	629,292	279,053	113,191	117,395	28,347	1,540,978
1943	1,265,212	982,745	854,733	239,701	313,785	59,521	3,715,697
1944*	1,810,821	1,130,363	671,181	157,024	439,082	49,678	4,258,149
Accumulative Total	$3,488,143	$2,742,435	$1,848,319	$517,709	$879,245	$137,909	$9,613,760
Total, Lend-Lease Exports	$11,332,487	$7,436,767	$3,523,684	$1,149,196	$1,760,081	$207,699	$25,409,914

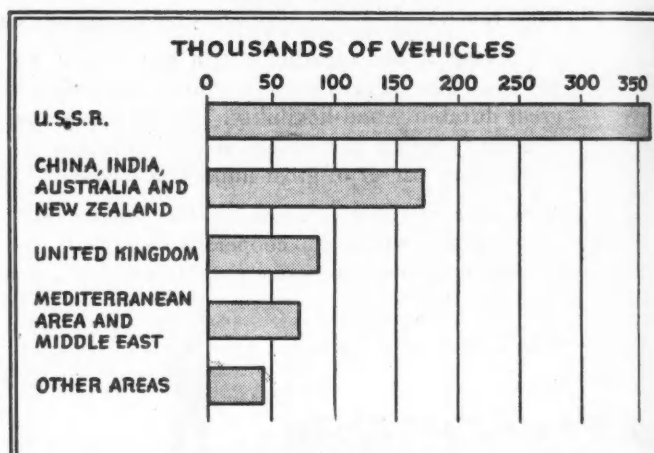
* January through November. † Also includes vehicles. ‡ Includes cumulative shipments to China, 1941 through 1943.

Lend-Lease Aid by Category

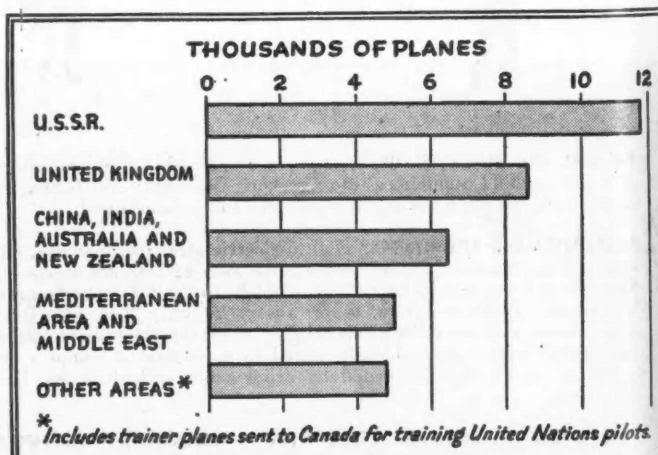
March, 1941 Through December, 1944

		Per Cent of Total
GOODS TRANSFERRED		
Munitions:		
Ordnance	$1,198,545,000	3.39
Ammunition	2,398,731,000	6.78
Aircraft	4,326,483,000	12.23
Aircraft Engines, Parts, etc.	2,088,929,000	5.90
Tanks and Parts	3,279,215,000	9.27
Motor Vehicles and Parts	1,656,359,000	4.68
Watercraft	3,184,048,000	9.00
Total	$18,132,310,000	51.25
Industrial Materials and Products:		
Machinery	1,636,571,000	4.63
Metals	1,656,558,000	4.68
Petroleum	1,568,184,000	4.43
Miscl. Materials	3,461,544,000	9.78
Total	$8,322,857,000	23.52
Agricultural Products:		
Foods	4,261,605,000	12.04
Other Agric. Products	693,456,000	1.96
Total	$4,955,061,000	14.00
Total Transfers	$31,410,228,000	88.77
SERVICES RENDERED		
Rental of Ships, etc.	$2,704,900,000	7.64
Servicing, Repairs of Ships	532,335,000	1.50
Production Facilities in U.S.	628,519,000	1.79
Miscellaneous Expenses	106,664,000	.30
Total Services	$3,972,418,000	11.23
TOTAL DIRECT AID	$35,382,646,000	100.00
Consignments to U. S. Commanding Generals for subsequent transfers under Lend-Lease	$788,083,000	

WHERE LEND-LEASE VEHICLES HAVE GONE
TOTAL TO DEC. 1, 1944



WHERE LEND-LEASE PLANES HAVE GONE
TOTAL TO DEC. 1, 1944




TANGENTIAL RING TENSION SCALE

Spare Bomber Parts from Ford

The equivalent of more than 1,000 Liberator bombers has been built in spare parts at the Ford Willow Run bomber plant which has been assigned the task of supplying parts for the AAF.

Made and assembled along with regular flyaway bombers, the parts are shipped and flown all over the world through the 831st AAF Specialized Depot at Shelby, Ohio.

For every seven B-24s built at the plant, an equivalent of an extra bomber in spare parts must be produced.

Approximately 70 per cent of all spare parts required for the four-engined bombers come from Willow Run, and 85 per cent of all the emergency requests for parts are handled there. The latter often are flown from the plant directly to the battle fronts.

The amount of each part or assembly to be produced is determined by what is known as the "part fatality record," which shows the frequency of requests for specific parts.

In the beginning emergency requests ran as high as 100 a day, but many emergency requests have been eliminated by watching the fatality trend of parts.

U. S. Exports of Aeronautic Products*

AIRCRAFT

Year	Number	Value
1912	29	$105,806
1913	29	81,750
1914	34	188,924
1915	152	958,019
1916	269	2,158,395
1917	135	1,001,542
1918	61	768,729
1919	44	215,300
1920	65	598,274
1921	48	314,940
1922	37	156,630
1923	48	309,061
1924	59	412,730
1925	80	511,282
1926	50	303,140
1927	63	848,508
1928	162	1,759,663
1929	348	5,464,600
1930	321	4,819,600
1931	140	1,812,800
1932	280	4,358,967
1933	406	5,391,493
1934	490	8,195,404
1935	333	6,598,515
1936	527	11,601,803
1937	631	21,086,170
1938	876	37,977,924
1939	1,221	67,112,806
1940	3,531	196,265,840
1941	6,011	422,763,907

AIRCRAFT ENGINES

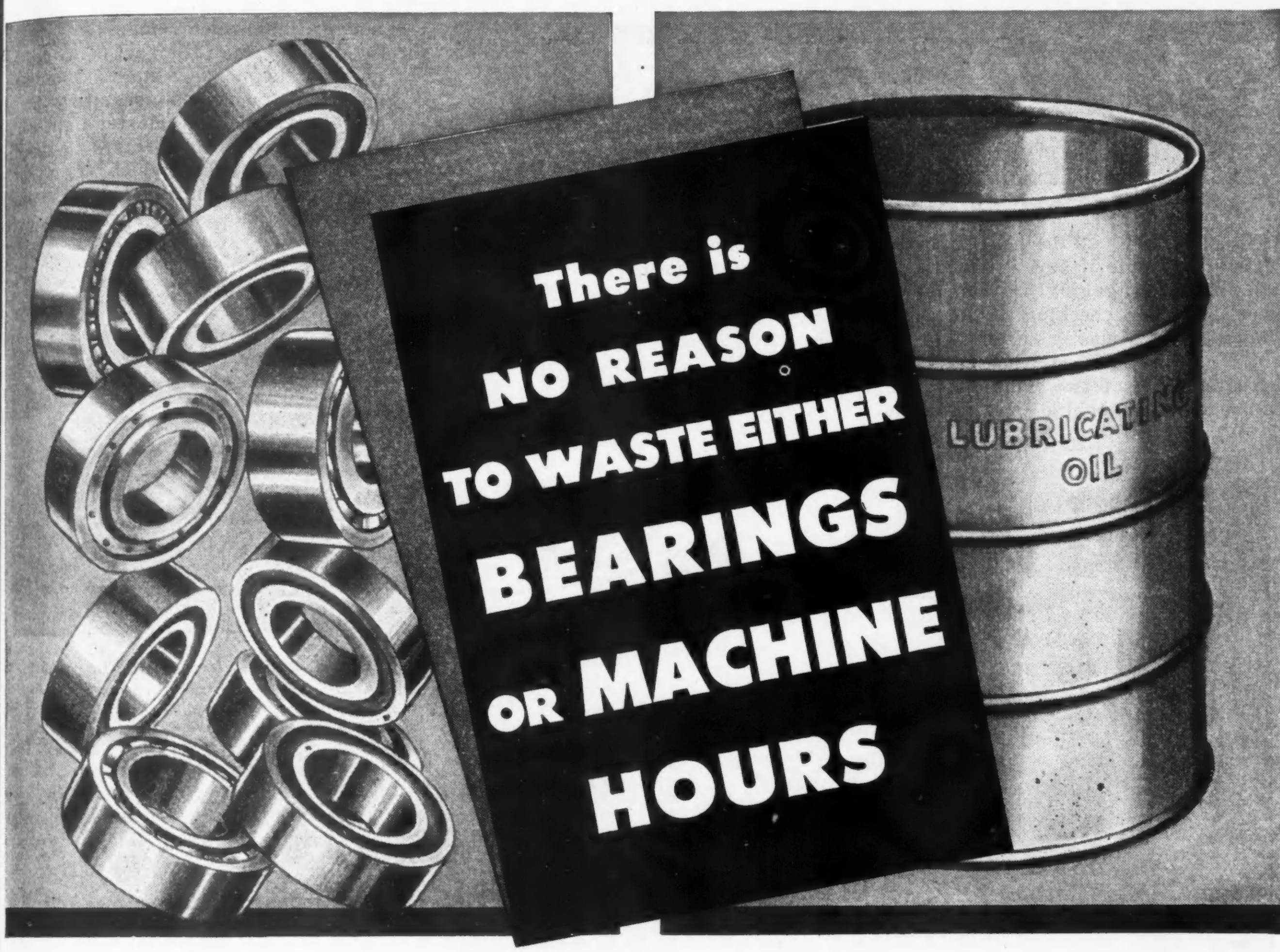
Year	Number	Value
Not reported prior to 1922.		
1922	147	$72,810
1923	80	65,558
1924	146	219,600
1925	73	170,703
1926	297	573,732
1927	84	484,875
1928	179	664,828
1929	322	1,383,197
1930	376	1,634,905
1931	307	1,432,229
1932	2,356(a)	1,517,682
1933	2,903(a)	1,452,341
1934	1,009	4,458,701
1935	566	2,459,317
1936	933	5,182,469
1937	1,048	5,946,054
1938	1,309	7,899,844
1939	1,880	14,120,035
1940	4,986	49,873,823
1941	8,144	81,692,907

(a)—Russia bought 2,010 engines in 1932 and 2,576 in 1933.

Year	Aircraft Parts and Accessories• Value	Total, Aeronautic Exports Value
1912	$........	$105,806
1913	25,802	107,552
1914	37,225	226,149
1915	583,427	1,541,446
1916	4,843,610	7,002,005
1917	3,133,903	4,135,445
1918	18,017,781	18,786,478
1919	3,249,226	3,464,526
1920	554,375	1,152,649
1921	157,608	472,548
1922	265,481	494,930
1923	58,949	433,558
1924	165,926	798,273
1925	101,584	783,659
1926	150,329	1,027,210
1927	570,117	1,903,560
1928	1,240,244	3,664,723
1929	2,257,548	9,125,345
1930	2,363,456	8,818,110
1931	1,622,649	4,867,687
1932	1,756,421	7,946,533
1933	2,249,172	9,180,328
1934	4,860,567	17,622,938
1935	5,069,810	14,290,843
1936	6,060,483	23,143,203
1937	12,105,474	39,404,469
1938	21,948,982	68,227,689
1939	36,574,311	117,807,212
1940	65,732,004	311,871,473
1941	122,472,538	626,929,352

•—Includes parachutes and parts.

* Motive Products Division, Bureau of Foreign and Domestic Commerce.



The only thing a bearing needs is clean lubricant. The things that ruin bearings are grit, moisture and inadequate lubrication.

Chicago Rawhide "Perfect" Oil Seals keep the lubricant where it belongs and exclude both grit and moisture. This is vouched for by the Automotive Industry, the Agricultural Implement Industry, the Machine Tool Industry and others.

For your postwar products include "Perfect" Oil Seals.
ASK Chicago Rawhide Engineers for their recommendations.

CHICAGO RAWHIDE MANUFACTURING COMPANY
1310 ELSTON AVENUE • CHICAGO, ILLINOIS
66 YEARS MANUFACTURING QUALITY LEATHER GOODS EXCLUSIVELY AND NOW SIRVENE SYNTHETIC PRODUCTS
Philadelphia • Cleveland • New York • Detroit • Boston • Pittsburgh • Cincinnati

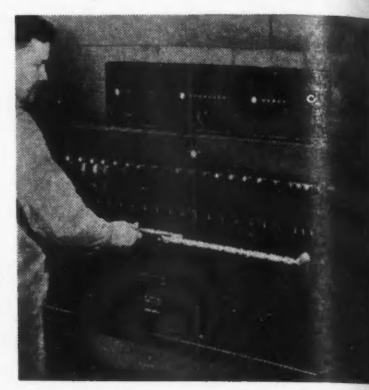
New Production Equipment

THE Sheffield Multichek illustrated is an example of how a multiple electric precision gaging instrument has been built for checking of 21 outside diameters of a master camshaft.

Each of the 21 Electrichek gage heads actuates a set of two individual signal lamps mounted behind a common port in the light case. Lights remain off when the dimension is within tolerance limits. When a light bulb shows red, it indicates that the dimension is under the minimum tolerance limit, while a green light signifies the dimension is larger than the maximum.

The operator needs to watch only one master light which remains off when all the dimensions of the part being checked are within tolerance limits. If any one or more dimensions are either undersize or oversize, the master light comes on, and the operator refers to the diagram panel to see which signal light shows red or green to indicate the error.

The Multichek is a development of The Sheffield Corporation of Dayton,



Sheffield multiple gaging instrument

Ohio. Although largely built up from standard units, the instruments are "tailor-made" to meet individual requirements and are recommended where inspection is required of a large number of pieces.

THE Landis Tool 10-in. by 20-in. Type H hydraulic universal grinder was designed, by the Landis Tool Co., Waynesboro, Pa., to turn out quantities of small, accurate parts in tool rooms, or on a mass production basis.

In general appearance this Landis grinder resembles the 4-in. by 18-in. Type H plain machine; the major differences are the universal wheel head and universal headstock. The bed is of the rigid, box type design with integral-

Landis Type H hydraulic universal grinder

ly cast compartments for the coolant reservoir, control, hydraulic and electrical equipment. Bed design prevents headstock or footstock overhang at any position of the carriage. The Vee and flat guides are constantly lubricated by a metered amount of filtered oil.

The headstock is driven by a constant

(*Turn to page 88, please*)

torque type variable voltage motor. This self excited motor has a work speed range of 90 to 600 rpm and drives the headstock spindle through Vee belts. The head swivels up to 90 deg for face grinding. The grinding wheel head is mounted on a sub-slide and swivel base. It may be swiveled 90 deg either side of zero and may be moved 4 in. forward or back to obtain additional work clearance.

TO ENABLE control of the surface finish of large-caliber, high-explosive shells, Physicists Research Co., Ann Arbor, Mich., has brought out its Type CP Roughness Meter. The Roughness Meter provides measurements of average roughness on extremely coarse surfaces such as shells, in the same manner as the Profilometer provides similar readings on smoother machined surfaces.

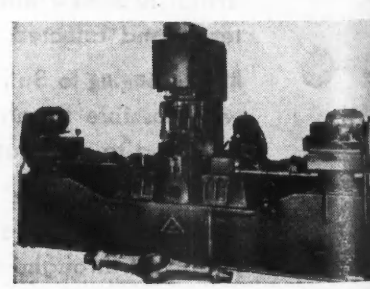
Readings of the Roughness Meter are directly in microinches of average

Type CP Roughness meter

roughness of the surface being measured. The meter and the scale selector provide full scale ranges of 300, 1000 and 3000 microinches. In appearance the Roughness Meter greatly resembles the Profilometer and in principle and operation the instrument is essentially similar.

The tracer is designed for hand operation and is heavier than the Profilometer Tracer. It has a blunt diamond point for tracing the surface. The diamond point is automatically self-adjusting to any curvature from 1½ in. OD to flat.

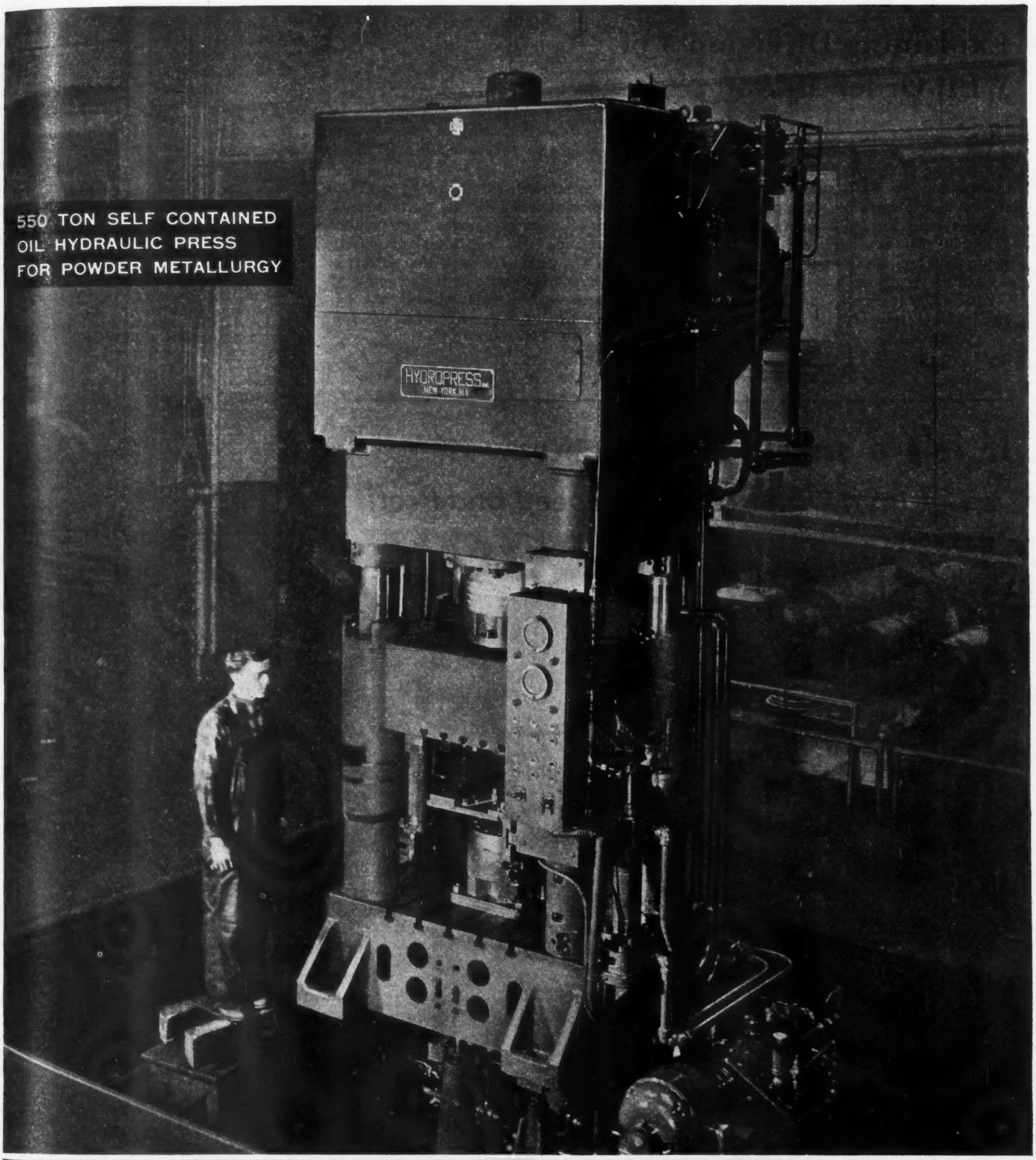
A SPECIAL machine for drilling 29 holes from 4 directions in a truck axle mounting or carrier has been built



Special LeMaire drilling machine

by LeMaire Tool & Mfg. Co., Dearborn, Mich. Four standard LeMaire twin ram hydraulic units combine to form this machine. Two units in horizontal

(*Turn to page 164, please*)


550 TON SELF CONTAINED
OIL HYDRAULIC PRESS
FOR POWDER METALLURGY
HYDROPRESS INC.

Explaining Direction 3 of WPB Order M-293

By Joseph Geschelin

DIRECTION 3 to WPB Order M-293 is one of the most far reaching actions taken by WPB since the inception of the war program. Its sphere of influence—"all kinds of parts and parts of parts for internal combustion engines"—is so clearly defined; its implications so patent, as to make it imperative for the parts producers of the automotive industry to understand its effect upon the future course of their business.

The preamble says there exists a "most urgent need for the maintenance of engines now in service, and scheduling actions will be taken primarily in such way as to insure the satisfaction of that need, even at the expense of new engine production where that becomes necessary." Specifically, the following actions may be taken by WPB in plants producing engines or parts:

(1) Direct the filing and freezing, or the preparation and freezing without filing, of production or shipping schedules, in whole or in part.

(2) Direct changes in the production or shipping schedules of any manufacturer. These actions may, among other things, relate to segments of production, segments of shipping capacity, specific purchase orders, or classes of purchase orders.

(3) Direct the inclusion of unrated purchase orders as a class in frozen schedules, or the exclusion of unrated purchase o rders as a class from frozen schedules, and specify the manner of inclusion or exclusion.

(4) Direct the allocation and setting aside of specific percentages of parts on hand, produced, to be produced, or to be received for shipment as directed on specified purchase orders or classes of purchase orders; and change such percentages from time to time as to any or parts.

(5) Direct the shipment of parts instead of engines by any engine manufacturer on specified orders, or classes of orders, and direct changes in any frozen schedule for internal combustion engines which may be deemed necessary to carry out directions for the shipment or setting aside of parts under this direction.

(6) Direct the return or cancellation of any purchase order on the books of a manufacturer.

(7) Direct the acceptance of purchase orders for parts, and direct a schedule of shipments for such purchase orders.

(8) Cancel purchase orders placed with one manufacturer and direct that they be placed with another manufacturer.

(9) Take such other action as it deems necessary with respect to the ordering, production or shipment of parts.

To administer this order properly, WPB has set up a special branch or department headed by Robert M. Hatfield who has the title of Special Assistant to the Office of the Operations Vice-Chairman of WPB. His staff consists of a group of special civilian assistants and an advisory group of ranking officers representing the armed services.

Why Direction 3? In the hectic days of '42 the U. S. Navy was more concerned with building engines, so that military vessels could be commissioned, than it was with the making of parts for the same engines. We had to have ships first.

But as thousands upon thousands of engines were built for the Army and Navy and as they began to spin and wear, the emphasis shifted to spare parts to keep them running. Before long it was evident that the industry producing engines and parts had to build not only more and more engines but also more and more parts. Moreover, these needs had to be met simultaneously.

Now it is common knowledge that most component parts and all accessories used in engine production are not built by the engine manufacturers but are purchased from some thousands of suppliers. The demands upon the parts makers—coming from every area of war production—were such that they were unable to take care of everyone. They could produce so much and no more.

This situation engendered two basic philosophies which Direction 3 seeks to pre-emp. The first of these was that

(Turn to page 92, please)

there is just so much to go around. Let's divide it the best we can. Everyone will have less than he needs but each one will have something. Little thought was given to the real problem—if there is not enough, let's make more. Make enough to take care of everybody. Make enough to take care of the essential civilian demands as well.

Late in '43 it was concluded that the war economy had absorbed as much plant expansion as was needed to fight the global war. It was also concluded that we had built all the machine tools that could possibly be used. That put the brakes on further expansion except for certain special programs.

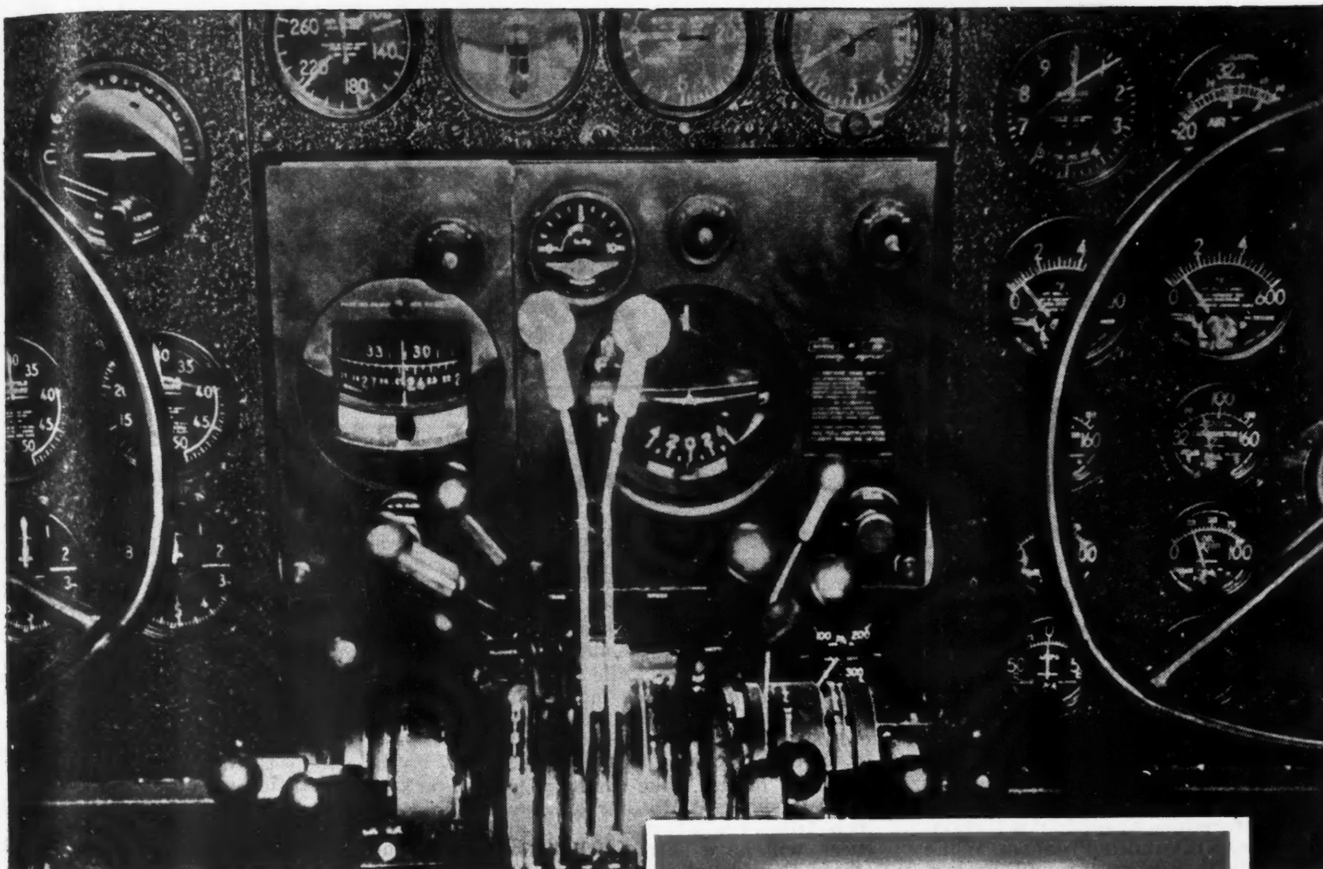
However, the Navy was spinning millions of engine horsepower and burning up parts at a rate beyond conception. The Army was piling up trucks and tanks on the roads of Western Europe—equipment that could not roll for lack of parts. That was the setting for Direction 3.

It takes time to create new sources and to increase the capacity of existing facilities. Even though remedial action is taken there is a trying period when shortages continue to plague everyone. During this interim period Direction 3 gives complete authority to say who shall be served first; how schedules must be changed to accomplish this end; who shall do what. Wherever there is a critical shortage Direction 3 provides the means for taking charge of the situation, if need be, by setting up a Task Group in the plant to study the order board and to schedule production so as to satisfy the most pressing needs first.

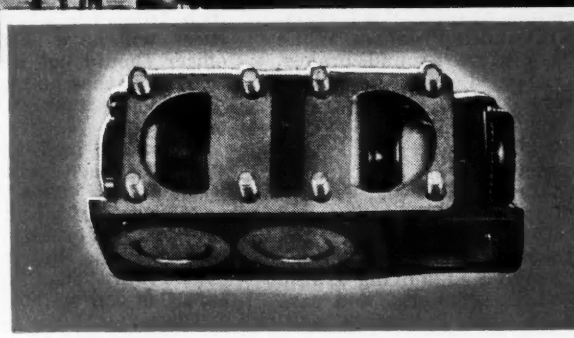
At the Engine Parts Coordinating Office (EPCO) of the Bureau of Ships in Detroit, Mr. Hatfield has established a committee consisting of his Deputy, an Army officer representing the Army Service Forces, and a Navy officer representing all bureaus of the Navy. This committee has delegated authority which enables it to judge certain problems and to issue directives on parts plants and engine builders so as to take care of urgent needs for spare parts. From this level the control in the field fans out through "Task Committees" established in a number of engine plants and parts plants. These committees live in the plant, become acquainted with the problems of management and of the claimants and are in position to take certain directive actions on their own initiative and to pass certain broader problems for considerations by the Senior Committee at EPCO. Any conflicts or interferences which cannot be reconciled in the field are presented to the Hatfield Committee in Washington for final disposition and action.

At the present writing some of the most critical items in the parts picture are the following: Engine bearings, cylinder sleeves, piston rings, pistons, flywheel ring gears, bushings, gaskets,

(*Turn to page 162, please*)



Photo, courtesy Lockheed Aircraft Corp., Aviation Magazine



VALVE No. 93243. Two-fold function; protects oil cooler from high pressure surges; controls oil temperature by automatically apportioning oil passing through cooler. Release mechanism prevents dangerous temperatures in event of accident.

LESS TO WORRY ABOUT

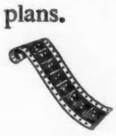
A FORMIDABLE ARRAY, isn't it, that expanse of instruments and controls?

To the layman, yes. But today's experienced pilot long ago learned to take things like this in his stride. He knows flying, of course. In addition, he knows his plane thoroughly, knows how to take advantage of controls such as the one shown in the insert above.

This instrument, a compound Fulton Sylphon Control Device, frees him from oil line worries. It protects the oil cooler from high pressures which cold-congealed oil might build up at the start. And, as the engine revs up to full power, it holds circulating oil temperatures within narrow pre-determined limits, thus assuring proper viscosity, full power and correct lubrication.

For nearly half a century, Fulton Sylphon Controls have been doing jobs like this...performing tasks *automatically* far better than can be done *manually*.

Write today for complete information. Ask for Bulletin FB-822. It belongs in your reference files for post-war plans.



New Movie—"The Story of Metal Bellows" is available to interested executives and organizations everywhere.

FULTON SYLPHON

TEMPERATURE CONTROLS

BELLOWS ... BELLOWS ASSEMBLIES

THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

Canadian Representatives, Darling Brothers, Montreal

NATION'S POLICE TO LAUNCH *Brake Check Program*

By BRIG. GEN. D. C. DRAPER, *President*
International Association of Chiefs of Police

ACCIDENT reporting in general has not been detailed sufficiently to determine accurately the extent brakes contribute to the annual toll of life and limb on the highways. However, it is plainly evident that brakes, good or bad, are called into play in almost every accident. Many accidents would have been less serious or avoided entirely if all the cars involved had good brakes.

To further aid in the war effort, the International Association of Chiefs of Police determined to conduct a Nation-Wide Brake Emphasis Program. While the program centers around brakes, which are regarded as a symbol of safety by motorists, it will, it is hoped, stimulate the public to take better care of the car in general.

The program will be launched in every state April 15 and end June 1. During that period the police and sheriffs of the nation will check the brakes of passenger cars only which have been involved in moving traffic violations and in accidents, and cars operated in a manner indicating inadequate brakes. It is not a blanket check covering all motorists, but a check covering the above situations only. The check takes but a minute to make. In no way is the program a substitute, rather it will supplement everyday police enforcement and safety work.

Developed through careful research, the brake check takes into full consideration the current problems of traffic law enforcement and the engineering and mechanical aspects involved. Simplicity is its dominant characteristic. The method has been given full trial in one large state with highly successful results.

When an officer has stopped a car for a moving violation, he asks the driver to vacate the driver's seat. The officer then opens the car door on the driving side, leaves it open while he performs the simple act of depressing the brake pedal with the toe of his right shoe. In this manner he determines the distance between the pedal and the floorboard when the brakes begin to grip.

If the pedal depresses to within one inch or less of the floorboard before the brakes begin to grip, or take hold, the brakes are inadequate and need immediate attention.

The most convenient way of determining this is to place a piece of wood one inch thick on the floorboard under the pedal. If the pedal strikes the piece of wood before the brakes take hold, the car fails to pass the check.

If the brakes grip while the pedal is slightly more than one inch from the floorboard, they are not to be considered safe and the driver should be urged to have corrective measures taken.

If the brakes take hold while the pedal is substantially higher than one inch from the floorboard, the brake check will have been passed, but the officer should not in any case inform the driver that he has safe brakes. His brakes have merely met the check conditions.

When one inch, or less of distance exists between pedal and floorboard when brakes begin to grip, the brake pedal actually hits the floorboard before enough pressure can be built up to make the lining grip the brake drums hard enough to stop the car safely in emergency situations.

The average car requires about 130 pounds of line pressure to permit brakes to do a maximum job. With only one inch of effective distance left it is possible to build up only about 50 pounds of line pressure. This is little more than one-third of the pressure necessary for maximum stopping ability.

When only one inch of distance from the pedal to the floorboard remains, in addition to a lack of adjustment of the brake pedal, there is possibility of other unsafe brake conditions.

When less than one inch of distance is left, about 60 feet will be required to stop a car at 20 miles per hour. This is twice the maximum distance allowed by most state laws for stopping a car. The dangerous condition of such brakes then becomes immediately apparent.

If a car passes the brake check it does not follow that the brakes are safe. It means the brakes have merely met the check requirements.

It is a sound enforcement device whereby inadequate brakes can be detected. When it is desired actually to test the brakes a decelerometer, or some other test legally recognized in a particular state, should be used. The program, however, concerns itself only with the one-inch brake check, a war-time device designed to enable any police officer to recognize inadequate brakes.

That the brake check is practical and should produce invaluable results was demonstrated by a similar check made last year in Michigan. In that state accidents had been rising for seven consecutive months when the brake check was started. As compared with the same months of the previous year, during the first month of the program fatalities were fewer by 33 per cent, and in the second month the drop was 31 per cent. In the third month, when the program was inoperative, there was a carry-over reduction of 16 per cent.

When the check was initiated, one of every seven cars failed to meet requirements. At the end of the program only one car in 23 failed to pass. That marked decrease is evidence that the program influenced drivers in general to have their brakes inspected and adjusted or repaired.

At first blush one might think a check calling for only one inch of pedal travel after the brakes grip would find few cars unable to pass. The Michigan check showed that such is not the case. In that state approximately 11 per cent of all cars checked failed to meet the one-inch requirement.

In other states, too, the need for a brake emphasis program has been indicated. State motor vehicle inspections made last year in New Jersey produced 30 per cent rejections because of inadequate brakes, and in New Hampshire, 19.5 per cent. Those figures are probably indicative of the situation throughout the country.

Among the organizations supporting the program are the Office of Defense Transportation, U. S. Army Service Forces, the Office of War Information, the American Association of Motor Vehicle Administrators, the American Association of State Highway Officials, the Highway Traffic Advisory Committee to the War Department, the National Safety Council, the Automotive Safety Foundation, the National Conservation Bureau, the American Automobile Association, and the National Post-War Traffic Safety Committee, composed of 48 national organizations interested in safety. Altogether nearly one hundred groups will support the program.

Sponsored in the Interest of Nation-wide Brake Inspection Drive by
Kelsey-Hayes Wheel Co., Detroit, Mich., and Empire Electric Brake Co., Newark, N. J.

Some Cases for Steel as a Material

*By E. P. Strothman**

Engineering Consultant, A. O. Smith Corp.

STEEL was successfully used for the replacement of magnesium in the B-29 bomber nose frame and in many ways was preferable for this light-weight service. Weight calculations revealed that the steel structure could be slightly lighter in weight than the magnesium structure and satisfy all the functional requirements. A finished structure of identical shape, though different in cross-section, was constructed so that the specially-formed and cut ellipsoidal glass and plastic transparencies could be utilized together with the same method of cover-plate fastening. Weight, however, was but one of the important factors; there were strength and stiffness still to be considered.

With this structure designed to resist the internal pressure of the pressurized cabin, it was vital that the structure remain pressure tight under all service conditions, such as impact in landing or when pierced by enemy action, and with changes in temperature and internal pressure. The irregular nature of the ellipsoidal shape so complicated the problem of strength and stiffness determination that simple, comparative analysis was the most practical approach. The frame structure was accordingly divided into the principal cross-sectional members, or ribs, and each separately compared for strength and stiffness. Formed, pressed shapes of a high strength, low alloy S.A.E. 4340 material with a yield strength of 135,000 psi, or nearly eight times the 17,000 psi yield strength for the cast magnesium material, was selected to compensate for the four times greater unit weight of the steel material. With this selection of steel, the calculated strength index of the greatest-stressed upper struts, or rib members, proved to be more than double that of the cast magnesium. But the calculated stiffness ratio of these same steel ribs proved to be only half that of the cast magnesium ribs; so evaluation of the stiffness factor became most important.

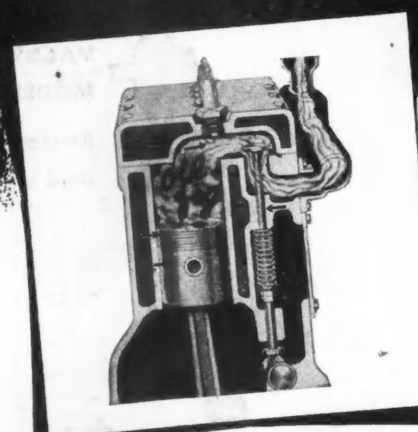
This comparative method of separate rib analysis served primarily to compare weight and to indicate the possibilities for an alternative construction that justified building an actual steel nose frame of the design suggested. This became the only suitable procedure to answer the indeterminate questions and to evaluate the composite stiffness of the redesigned frame.

Experimental testing of the welded steel frame, complete with assembled transparencies, proved most revealing. It was found practical to produce an actual assembled steel frame of comparable weight as estimated. At the specified pressure, no leakage occurred, and, by progressive pressure increases, a greater pressure was sustainable without leakage than had been possible with the cast magnesium frame. Even after leakage, there was no sign of structural weakening and it was further indicated that even greater safe pressures were possible with but minor increases in weight to provide the necessary stiffness to prevent leakage. This latter factor, together with the greater resistance to frame cracking or rupture and the fact that the structure could be readily field-repaired in an emergency, were additional advantages favorable for steel. Production and quality control were simplified with steel construction and reclaiming of rejected frames was a simple matter.

To summarize, the findings for the B-29 bomber nose-frame redesign and

(*Turn to page* 148, *please*)

* Abstract of paper presented at the War Engineering Annual Meeting of the Society of Automotive Engineers, Jan. 8-12, 1945, at Detroit.



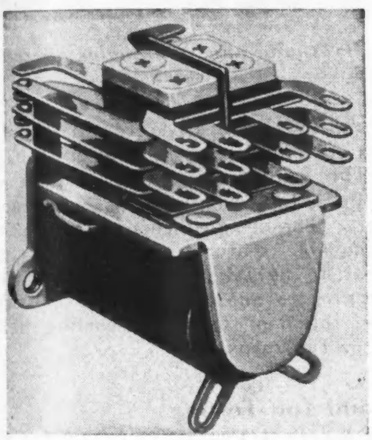
New Products for Aircraft

Lightweight Relay

Weighing only 1¾ oz, the R-B-M Type 23000 signal and communication relay manufactured by R-B-M Manufacturing Company, Logansport, Ind., is now being used in air-borne radio transmitters and receiving sets.

This electrical relay is said to be equally adaptable for other applications requiring exceptional resistance to vibration, humidity, and temperature extremes.

Specifications include 6 normally open contacts; contact rating, 3 amps



R-B-M Type 23000 relay

d-c non-inductive. Also available in other arrangements of normally open and normally closed contacts. Vibration resistance up to 10 g's at 40,000 ft; temperature ranges, —65 C to 85 C; approximate dimensions, 2 1/16 in. long, 1½ in. high, ⅞ in. wide. Design and construction meet Signal Corps requirements for resistance to humidity, salt spray, and fungus.

New 700-Hp Cyclone Aircraft Engine

A seven-cylinder Cyclone aircraft engine using low-octane fuel and developing 700 hp is announced by the Wright Aeronautical Corp. and the Curtiss-Wright Corp., New York, N. Y. It follows the conventional design of air-cooled radial engines generally and resembles the Cyclone 9—but has seven cylinders instead of nine, and combustion chamber design appropriate for gasoline of an octane rating considerably below that used in American warplanes and transports. Horsepower output would be correspondingly greater with the use of the highest octane fuels.

Close resemblance to the Cyclone 9, it is claimed, makes possible interchangeability of many parts of the nine-cylinder and seven-cylinder types, simplifies maintenance problems, and makes possible more economical manufacture.

The new cylinder assemblies embody longer valve guides, greater cooling fin area in the vicinity of exhaust valve guide bosses and a self-aligning exhaust valve seat to insure proper alignment of the valve. Barrels of cylinders incorporate aluminum fins for improved cylinder barrel cooling, and the cylinder heads are forged aluminum.

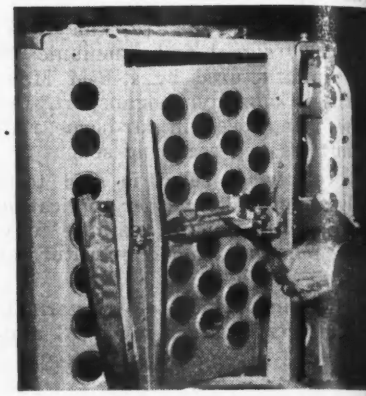
The valve gear lubrication system makes use of a series of external oil tubes to increase the lubrication of valves and oil jets have been provided in the engine's crankcase to direct a continuous flow of oil.

The Cyclone 7 is provided with a two-speed supercharger drive. The higher supercharger ratio is 8.686:1, the lower ratio is 7.208:1.

(*Turn to page 102, please*)

Aircraft Seat with Hydraulic Locking Device

Featuring the recently developed "Hydrolok" seat locking mechanism, a new light weight seat designed by Douglas Aircraft Co., Inc., Santa Monica, Cal., which reduces the weight per 21-passenger plane by 147 lb is now



Hydraulic unit of Douglas aircraft seat

being installed in reconverted DC-3s at the company's Santa Monica plant.

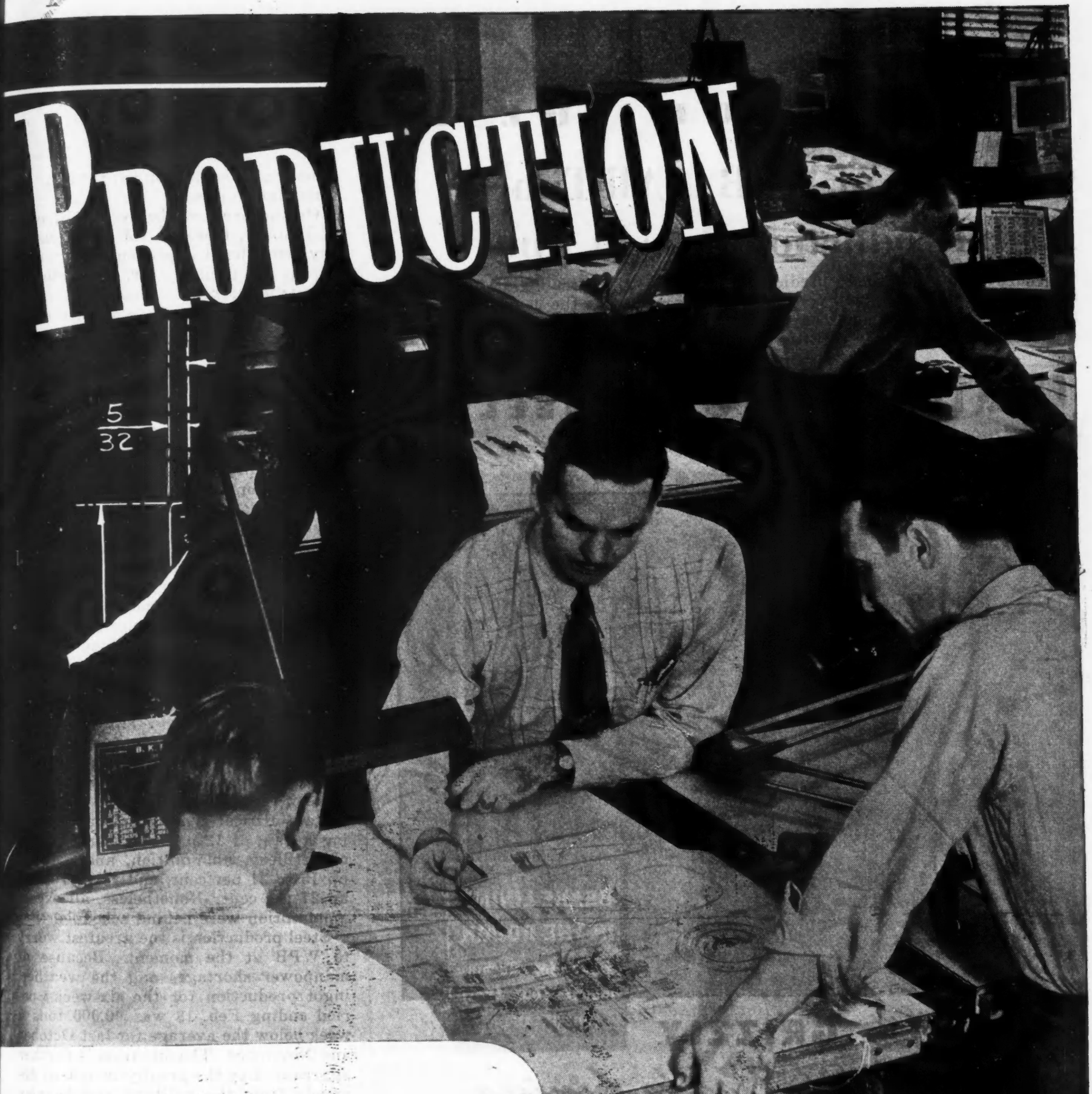
The seat lock control in the new Douglas light weight seat is a hydraulic unit. The design incorporates a quick-removable feature which permits the seats to be taken out in a very few minutes to adapt the plane for cargo use, the floor fittings becoming light-cargo tie-downs.

Stand for Testing Carburetor Floats

The Amsco Model A 801 carburetor float stand, made by Airplane Manufacturing & Supply Corp., North Hollywood, Cal., has been designed to check the float level and needle and seat of aircraft float type carburetors. No out-

(*Turn to page* 158, *please*)

Amsco Model A801 carburetor float stand


PRODUCTION
5/32

Objective of WPB is All-Time High Production Rate in June

Even though guarded predictions that the war in Europe will be over by late spring or early summer have been circulating in Washington, WPB is proceeding with its all-out war production program as if the conflict were to last indefinitely. The announced immediate objective of that agency is to prod schedules steadily upward to an all-time high in June.

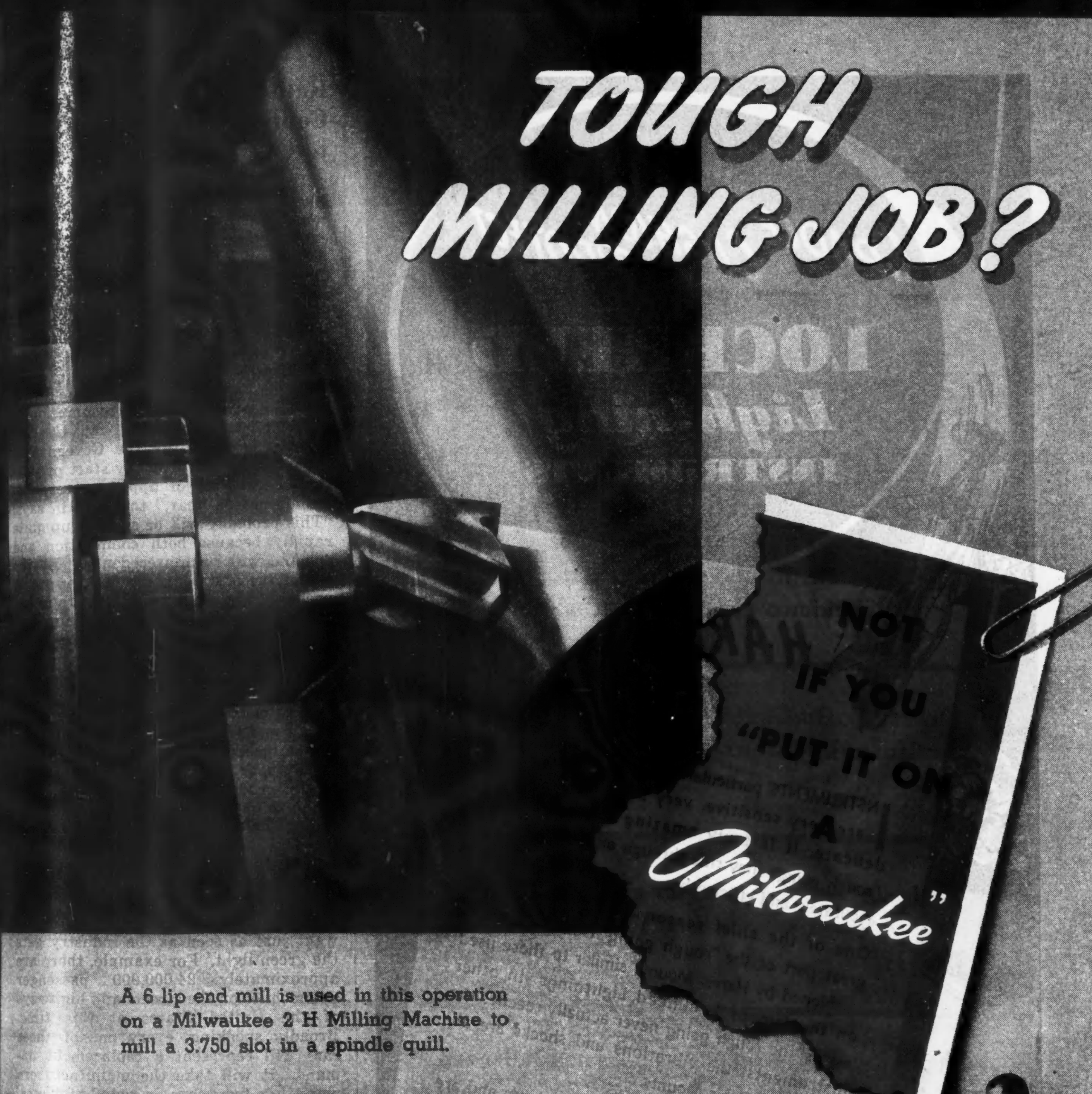
On the basis of the over-all showing in January, however, the prospects for any sensational improvement are nothing to get excited over. Even though production schedules had been set at only one per cent above the December level, January output wound up one per cent under the previous month, for a net loss of two per cent under schedule. Principal reason for the disappointing record in January, according to WPB, was the loss of production of raw materials, notably steel. This particular deficiency will be felt even more in the next two or three months. Other contributing factors for the lowered January output were the severe winter weather, worst since 1918, which caused difficulties with absenteeism, coal, natural gas, and transportation, and the increasing pinch on manpower. Of all the major munitions programs, only ammunition was ahead of schedule. Combat and motor vehicles were included among items that were behind both production schedules and December output. Aircraft, while showing a rise of one per cent over December, was 4 per cent behind schedule. There were somewhat substantial gains over December in some of the critical items, however, with certain critical types of aircraft showing a gain of 12 per cent, some classes of artillery, ammunition, and mortars up 15 to 21 per cent, and Navy rockets up 27 per cent. Nonetheless, all except ammunition were behind schedule.

Steel production is the greatest worry to WPB at the moment. Because of manpower shortages and the weather, ingot production for the six-weeks period ending Feb. 18 was 90,000 tons a week below the average for last October and November. The situation is further aggravated by the greatly increased demands from the military and heavier "cashing" of allotment tickets in the first quarter. Actually, what has happened is that the Controlled Materials

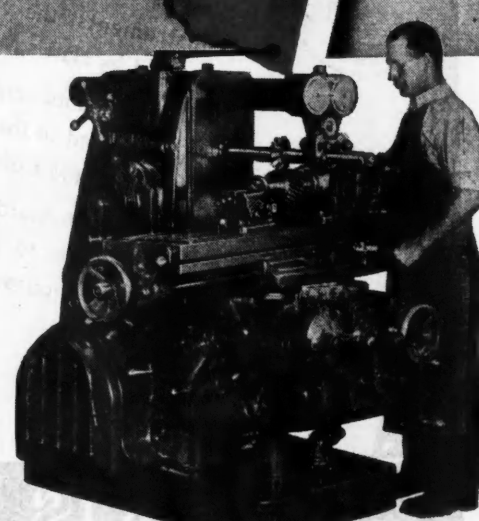
(Turn to page 144, please)

Crosley Plans to Build Small 4-Cylinder Car

Plans to produce a small four-cylinder car in the post-war period have been announced by Powel Crosley, Jr., president of Crosley Corporation. He did not state whether the car would be built by Crosley Corp. or by some other manufacturer, but said that it would have more power and better appearance than the two-cylinder model which the company built before the war. He stated that there is a definite need and market for a small automobile in the United States.



A 6 lip end mill is used in this operation on a Milwaukee 2 H Milling Machine to mill a 3.750 slot in a spindle quill.



The range—power—precision of Milwaukee Milling Machines—their exceptional ability to handle a wide variety of intricate, difficult milling operations at the most effective speeds and feeds — has made them the first choice of experienced purchasers.

"Put it on a Milwaukee" and you know the job will be done *right* — and with the least time and trouble.

Year after year you can be sure of sustained precision performance because every Milwaukee Milling Machine—is engineered and built in proper relation to its motor power — powerated!

Milwaukee Machine Tools

KEARNEY & TRECKER CORPORATION
MILWAUKEE 14, WISCONSIN

Rationing and Price Control of Automobiles to Continue After War

The end of the war will not mean the end of automobile rationing and price control, according to Ray Chamberlain, executive vice president of the National Automobile Dealers Association. The demand for cars will so far exceed the supply that the Government will be compelled to continue these measures for some time after peace comes, he points out in a bulletin made public recently.

"When we reach the place in the war's progress when the resumption of automobile manufacture can be considered expedient by the Government, the industry will probably start production at the rate of approximately two million cars a year," the bulletin says. "This probably will be stepped up quite rapidly because both competition and demand will be unprecedented. By the end of the first year, the factory people probably will be turning out cars at the rate of three and a half or four million a year. This stepping up process will continue into the second year after production is resumed, and I believe the industry will produce at least five million automobiles during that year. This would put production above the average in the most active prewar period. The third year after car-making starts again, production will in all likelihood go as high as six and possibly seven million units. I think that will be just about as high as annual production ever will go for a long time.

"It is obvious that the production figures I have given will fall far below the number of cars that the public will want just as soon as the industry gets the green light. For example, there are approximately 24,000,000 passenger automobiles on the streets and highways of the United States at this time. Broadly speaking, every one of these cars will represent a replacement demand. It will take the manufacturers more than five years, in round numbers, to supply this demand alone. And in the meantime, many new buyers will come into the market, to say nothing of the enormous number of returning soldiers who will want cars and who will stand at the top of the priority list."

P-80 Announced, World's Fastest Jet Plane

Although the P-80 Shooting Star jet plane has been flying more than a year, it was only recently announced by General H. H. Arnold, commanding general of the U. S. Army Air Forces. It is said to be faster than any planes the Germans or Japanese have flown.

Lockheed Aircraft Corporation's factories at Burbank, Cal., and the Kansas City factory of North American Aviation, Inc., are engaged in one of the most intensive production programs of

the war to hasten the new plane to the fighting fronts in quantity.

General Electric's G.E. turbo jet engine powers the P-80. The airframe was designed by Lockheed's chief research engineer, Clarence L. Johnson. The wings of the Shooting Star have a knife-like leading edge and other aerodynamic innovations that are said to master the problems encountered when the speed of sound is approached or surpassed.

Ceiling of the Shooting Star is well above that of propeller-driven planes. Thurst power of the engine is a restricted figure. Wing loading is less than that of an average fighter plane.

Standard Control Panel for Fighter Planes

A standardized panel for controls of machine guns, bombs, gun cameras, chemical tanks, and rockets will be used in American fighter planes. Designed to eliminate confusion and errors in operations, and to simplify training and familiarization of pilots, the new panel has been worked out by engineers of the U. S. Army Air Forces Air Technical Service Command and North American Aviation, Inc.

The wide and varied uses to which fighter planes have been put in various theaters of war have given the planes a wide assortment of armament which must be operated during periods of great stress. For this reason the Army Air Forces desired a standard control panel which would make the operation "automatic" in any type of plane.

North American Aviation was asked to submit a sample panel to meet certain specifications, and company and Air Technical Service Command engineers arrived at a panel arrangement which will be standard on new designs in all aircraft, and old designs will be changed wherever possible.

Since the wiring and mechanics of each armament control system are necessarily complex, the standard panel will make it easier to train mechanics and will lessen the possibility of mistakes in servicing.

Packard Forms Equities Board for Dealer Body

In a move to assure additional fair play for the dealer in his factory-to-field relationship, the Packard Motor Car Co. has formed a five-man equities board. Principal function of the board will be to review proposed dealer terminations. All facts concerning a proposed cancellation will be studied, at the dealer's request, before the termination is completed.

In considering a cancellation, the board will review complete records of the affected dealer's past performances, inspect his place of business, consider his plans for future development, and hear his own case in full.

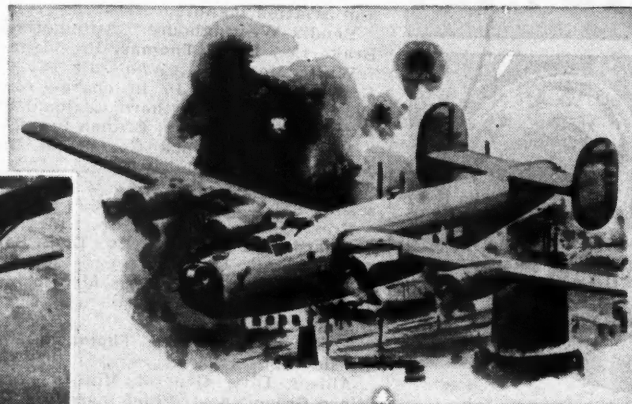
Kelsey-Hayes Will Handle Vacdraulic

William F. Penrose, vice president and general manager of Empire Electric Brake Company, Newark, N. J., and Geo. W. Kennedy, president of Kelsey-Hayes Wheel Company of Detroit, Mich., announce that an arrangement has been completed whereby Kelsey-Hayes will manufacture and sell Vacdraulic — the brake power booster — to manufacturers of trucks, cars and buses. Empire, through its wholesale sales organization, will continue to market its complete line of Vacdraulic brake power boosters to the automotive trade through its nation-wide distributing organization.

Colonel E. S. Gorrell

Colonel Edgar S. Gorrell, 54, president of the Air Transport Association of America, died March 5, in Washington, D. C., of a heart attack after a brief illness. He was engaged in the automobile industry from 1923 through 1935 as vice-president of the Marmon Motor Car Co., and president of the Stutz Motor Car Co. of America. In 1936 Colonel Gorrell became president of the Air Transport Association, a post which he held until the time of his death.

after the war?



4. **The Japs and Germans** didn't think that America, so unprepared, could produce *so much, so fast.* If they ever start another war, they will not forget their fatal error.

But they will not be apt to start another war if we keep America strong, invincible. The mere fact that we *possess* and *maintain* a powerful Army, Navy, and Air Force will discourage such unprovoked attacks as we suffered at Pearl Harbor.

American Air Power is one of our best guarantees of a lasting peace in a world where vengeful sparks of aggression may still be smouldering a generation hence.

3. **Your postwar "Flying Jeep"** may not look exactly like this. But you can be certain it will be safe, easy to fly, and an economical family plane. Well suited, too, for vacations, inter-city travel, for aero clubs and "Fly-it-Yourself" stations . . . for farmers, sowing and dusting crops . . . for forest patrol and fire spotting . . . for policing and traffic control . . . and for survey work . . . an ideal all-purpose small plane.

No spot on earth is more than 60 hours' flying time from your local airport

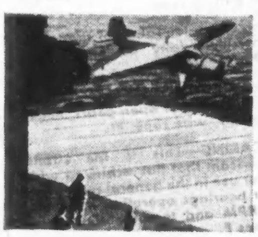
Don't miss it! The screen version of Moss Hart's great stage hit — presented by 20th Century-Fox, in association with the United States Army Air Forces.

"Winged Victory" is the name given by the heroes in the film to the Consolidated Vultee Liberator Bomber used in the picture.

MOSS HART'S

Winged Victory

PRODUCED BY DARRYL F. ZANUCK . . . DIRECTED BY GEORGE CUKOR.



RELIANT . . . *navigational trainer*

A favorite plane of many private flyers in peacetime, the wartime version of the Reliant is now used by Royal Navy pilots, for instrument-flight instruction and navigational training.

VALIANT . . . *basic trainer*

The Valiant is a swift, rugged two-place basic trainer, in which practically all of the Army and Navy pilots in this war received their basic training. This dependable trainer has a service ceiling of 21,000 feet.

(All the planes shown here were designed and developed by Consolidated Vultee)

CORPORATION

San Diego, Calif.
Vultee Field, Calif.
Fairfield, Calif.
Tucson, Ariz.
Fort Worth, Texas
New Orleans, La.
Nashville, Tenn.
Louisville, Ky.
Wayne, Mich.
Dearborn, Mich.
Allentown, Pa.
Elizabeth City, N. C.
Miami, Fla.

Member, Aircraft War Production Council

PERSONALS

Recent appointments among automotive and aviation manufacturers:

Bendix-Westinghouse Automotive Air Brake Co., **D. O. Thomas**, President.

White Motor Co., Wholesale Div., **T. M. Crisp**, Asst. to V.P. in charge of Sales. **W. F. Johnston**, Southern Regional Service Mgr. **Enoch F. Hicks**, Branch Service Mgr.

Mack Motor Truck Co., **P. J. Degnon**, Mgr. New England Div.

Taylor Tubes, Inc., **Rex L. Munger**, Advisory Sales Mgr.

Prest-O-Lite Battery Co., Inc., **W. J. Mergard**, Mgr. Chicago Div. **D. E. Sanders**, Mgr. Atlanta Div.

Toledo Scale Co., **Harris McIntosh**, Vice-President, Chg. Production and Engineering.

Western Gear Works, **Thomas J. Bannan**, President.

Allison Div., General Motors Corp., **H. Ward Groom**, Asst. Chief Inspector; **Carl V. Garrett**, Supt. of Receiving Inspection; **Raymond A. Wise**, Supt. Jet Engine Inspection, and **Wm. G. Shepherd**, Supt. Inspection on reciprocating engine parts.

The Glenn L. Martin Co., **Roger Ward**, Chief of Laboratories.

Edison-Splitdorf Corp., Div. of Thomas A. Edison, Inc., **Gustave D. Cerf**, Chief Engineer.

Federal-Mogul Corp., **Guy S. Peppiatt**, Executive Vice-Pres.

The Timken-Detroit Axle Co., **Louis C. Haltug**, Comptroller.

Graham-Paige Motors Corp., **Walter Beinecke**, Director.

Foote Bros. Gear & Mch. Corp., **L. F. Campbell**, V-P chg. of Mfg., **R. B. Moir**, Asst. V-P. chg. of Sales Engineering; **E. A. Johnson**, Asst. V-P., chg. of Mfg., Industrial Gear Div.; **I. C. McVicar**, Asst. Sec., and **L. J. Malina**, Asst. Treas.

Goodyear Tire & Rubber Co., **Joseph Nieberding**, Chicago field representative.

The Cleveland Graphite Bronze Co., **Max M. Roensch**, Chief Engineer.

General Controls Co., **A. E. Hess**, Mgr., Houston Branch.

The Lincoln Electric Co., **W. R. Persons**, Asst. Sales Mgr.

The La Pointe Machine Tool Co., **Don E. Miller**, executive assistant to Vice-Pres. and Works Mgr.

General Electric Co., **E. E. Potter**, Commercial Vice-Pres.; **P. D. Parker**, Gen. Sales Mgr., Lamp Dept., Eastern Sales Div.

General Motors Corp., **Captain James D. Mooney**, Vice-President, group executive of the Overseas Operations, member of the Administration Committee and member of Board of Directors.

Ford to Build Amphibious Cargo Carriers for Army

The Ford Motor Company will start production of nearly 10,000 amphibious cargo carriers (Weasels) for the Army, according to a recent announcement. Manufacture is expected to begin July 1. The order also includes a large quantity of spare parts.

The cargo carrier is a fully-tracked vehicle, capable of traversing all kinds of terrain and water. It has the lightest ground pressure of any war vehicle built, and will carry four soldiers or a driver and about 1200 pounds of cargo. The vehicle, also being built by Studebaker Corp., is about 189 inches long, 67 inches wide, 71 inches high and its weight, less crew, is approximately 5,640 pounds.

Exactly Right...

TO THE EXACT FOOT-POUND!

In many assembly and maintenance operations, tensioning studs and bolts *exactly right* is critically important. Distortion caused by inaccurate tensioning wastes power, promotes wear and is a frequent cause of mechanical failure.

With Snap-on Torqometers even inexperienced workers swiftly and confidently tension bolts to the correct foot-pound . . . and on delicate mechanisms, *to the exact inch-pound.* As the worker turns the nut he *sees* the tension increase — on the easily read dial . . . and stops at the specified pressure.

Snap-on Torqometers are widely used in aviation, and in other fields where precision in assembly and maintenance is essential to efficient performance. Torqometers are available in a full range of sizes from zero to 30 in. lbs., up to 2,000 ft. lbs. Torqometers are fully described in the new Snap-on catalog of 3,000 modern hand and power tools. Write for your copy.

SNAP-ON TOOLS CORPORATION

8054-C 28th AVENUE • KENOSHA, WISCONSIN

PUBLICATIONS

A new 8-page catalog issued by the Andrew C. Campbell Div., American Chain & Cable Co., features the **Campbell Hudorkut Model No. 1 Abrasive Cutting Machine.** The catalog contains interior and exterior pictures of the machine, also pictures typical pieces cut and close-ups of the cutting action, together with specifications and detailed information regarding the machine.*

Bulletin No. 51 describing **Type 4-L Single Planer Cabinet Surfacer,** has been issued by Buss Machine Works, views of the Planer are given, together with sectional views illustrating the latest developed features—the Quick Acting Micrometer Central Control for the Back Pressure Bar, Simultaneous Micrometer Adjustment for the Lower Rolls and the Shearing Bar in the throat of the cutterhead.*

Toledo Steel Products Co. has issued a new catalog sheet on the **Toledo Diatrol Piston.***

Propeller Theory, a new booklet published by Curtiss-Wright Corp. covers the essentials of the theory of the propeller. It contains useful information concerning the basic principles involved, including the rudiments of propeller construction and design.*

Oakite Products, Inc., has issued a 2-page Special Service Report describing the application of Oakite **Crys-Coat Process** to ferrous rods and wire in wire drawing. It gives all essential details and methods necessary to install the process or to make tests.*

The Texas Co.'s publication, Lubrication, for January, contains an article on **Analytical Physics** in the petroleum industry. The article contains a brief description of some unusual research instruments. Also included is a discussion of the uses and limitation of the Infra-red Spectrograph and the Mass Spectrometer.*

A new **Automatic Shaper Bulletin** (No. 1101) has been issued by the Onsrud Machine Works, Inc. Production benefits of a complete line of automatic shapers are described in the well-illustrated, information bulletin.*

Link-Belt Co. has issued a new 8-page booklet, No. 2045 on **shaft couplings.** Sizes, dimensions and list prices are given for couplings of flexible, rigid flanged face and compression types. Detailed information is also given on protective casings for the RC coupling.*

An 8-page condensed catalog, **Norelco Electronic Products,** has been announced by North American Philips Co., Inc. Included in the various subjects discussed is a chapter on film-type X-ray diffraction equipment and the new exclusive Geiger-Counter X-ray Spectrometer.*

W. F. and John Barnes Co. has issued a new folder on its **924 Vertical Drilling, Boring and Facing Machine.** The folder is illustrated with views of the machine and includes design and construction descriptions, together with specifications.*

Bulletin No. 139, by Twin Disc Clutch Co. describes and illustrates **Model P Air-Actuated Clutch.** Information on applications, design and construction, maintenance, advantages, capacities, etc., are included, together with specifications.*

American Screw Co. has issued a new price list for **slotted screws and bolts,** arranged for convenience and quick reference. Features of the new booklet are a thumb-type, cut-in index, re-arrangement of price information into three columns, etc.*

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* Obtainable by subscribers within the United States through Editorial Dept., AUTOMOTIVE and AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

Automatic Salvage System in Shell Plant

An automatic salvage system has been installed in Pontiac Motor Division's 155 millimeter shell plant to collect, prepare and load the four tons of steel turnings which accumulate every working hour. The system operates as follows:

As rough forgings are cut down to finished shells, turnings come from the batteries of cutting machines in continuous curled strips. Because of their bulkiness and spring-like tendencies they are extremely difficult to handle and wasteful of shipping space. Several men would be required to clear the turnings away from the machines and load them into freight cars. The automatic system requires the services of only two men.

Between the rows of cutting machines Pontiac has installed a trough several feet below the floor into which the turnings drop directly from the machines. They are washed along by the cooling fluid from the cutters which also is ejected into the trough. An elevated conveyor at length drops them into a chopper which converts them into small chips. Another conveyor then carries the chips by means of a vertical belt to the top of a loader from which they are disgorged directly into freight cars from the loader's movable spout.


HERE'S HOW EASY
IT IS TO
OPERATE
HANSEN
Push-tite
COUPLINGS
To connect coupling, merely push plug into socket, it locks tight and air is automatically turned on, no turning, no twisting.
Note when coupling is in use, all parts are protected. No pins to bend, no exposed parts to jam or freeze.
To disconnect, slide sleeve back with thumb, plug is automatically released.
Air is automatically turned off the instant plug is released, consequently no wastage of air
HANSEN MFG. CO.
Hansen PUSH-TITE Couplings are simplicity personified, not only in design, but in handling and in operation. They are quicker and easier to connect and disconnect, are fool-proof, leak-proof, compact and sturdy. Handle pressures from 2 ounces to over 12,000 pounds.
Hansen PUSH-TITE couplings have earned their world-wide popularity on performance, saving time, effort and costly air. There's a Hansen coupling made to handle air, oil, grease, oxygen, acetylene and gasoline.
Send for free industrial catalog.
HANSEN MFG. CO.
1786 EAST 27th STREET • CLEVELAND 14, OHIO

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Business activity is maintained at a high level, with an upward tendency indicated by current reports. *The New York Times* index for the week ended Feb. 17 stands at 143.5, as against 141.2 for the preceding week and 145.5 a year ago.

Department store sales during the same period, as reported by the Federal Reserve Board, were larger than in the preceding week and exceeded the figure for the corresponding period last year by 24 per cent, as against a comparable gain of 21 per cent a week earlier. The total for the year to date is 14 per cent above that of a year ago.

Railway freight loadings during the same period totaled 783,738 cars, 3.7 per cent above the figure for the preceding week and 1.2 per cent above that for the corresponding period last year.

Electric power production in the week ended Feb. 24 was slightly larger than in the preceding week and registered an increase of 0.7 per cent above the figure for the similar 1944 period, as against a year-to-year decline of 0.9 per cent the week before.

A new all-time record in crude oil production was set during the same week, with a daily average of 4,777,250 barrels, which is 8250 barrels above that for the preceding week and about 20,000 barrels in excess of the output recommended by the Petroleum Administration for War.

Production of soft coal during the week ended Feb. 17 is estimated at 11,515,000 net tons, as against 2,047,000 tons a week earlier and 2,065,000 tons a year ago. The total for the year to date is placed at 81,450,000 tons, as compared with 89,900,000 tons in the corresponding period last year.

Engineering construction contracts awarded during the week ended March 1, according to *Engineering News-Record*, totaled $38,982,000, which is more than double the figure for the holiday-shortened week preceding but is 1 per cent below the comparable 1944 figure. The total for February is $109,516,000, the lowest February figure since 1935 but 24 per cent above that for January.

The Irving Fisher index of wholesale commodity prices continues to move into new high ground, standing at 114.84 per cent of the 1926 average for the week ended Feb. 23, as against 114.50 a week earlier and 112.85 a year ago.

Member bank reserve balances declined $23,000,000 during the week ended Feb. 21, mainly as a result of a rise of $119,000,000 in money in circulation, which was largely offset by an increase of $85,000,000 in Reserve bank credit. Loans and investments of reporting member banks decreased $170,000,000 during the same period, with a decline of $56,000,000 in commercial, industrial and agricultural loans. Demand deposits rose $355,000,000, while Government deposits declined $538,000,000.

Advertising Note

H. J. Detterich, veteran automotive and industrial advertising man, has been appointed account executive on the staff of Florez, Phillips & Clark, Detroit marketing agency.

ARMY E NAVY

AWARDS

Names of winners of Army-Navy "E" awards in or allied with the automotive and aviation industries announced since the Mar. 1 issue of AUTOMOTIVE *and* AVIATION INDUSTRIES went to press:

S. BUCHSBAUM & CO., Chicago, Ill.
MARMON HERRINGTON CO., Indianapolis, Ind.
NATIONAL CARBON CO., INC., Charlotte Wks., Charlotte, N. C.
REMINGTON RAND, INC., Propeller Division, Johnson City, N. Y.

★ "E" Star Awards ★

for continuous meritorious services on the production front have been awarded to the following firms:

AMERICAN MACHINE AND METALS, INC., East Moline, Ill.
BROWN INSTRUMENT CO., Philadelphia, Pa.
GENERAL MOTORS CORP., Pontiac Division, Pontiac, Mich.
LAPOINTE MACHINE TOOL CO., Hudson, Mass.
WESTERN GEAR WORKS, Seattle Plant, Seattle, Wash.

Large Scale Production Of Jet Engines for AAF

The beginning of jet engine production on a volume schedule for AAF combat operations already is underway at the General Electric Company's second largest wartime plant at Syracuse, N. Y. Completion of the first of the superpowerful G-E jet engines recently at the Syracuse plant actually marked the beginning of mass production in the United States of this new motive power unit.

Polk Wins Army Ordnance Gold Medal

Louis Polk, president of The Sheffield Corporation, Dayton, Ohio, has been awarded the Gold Medal of the Army Ordnance Association for outstanding service. Mr. Polk has been instrumental in the development of measuring instruments and gaging system standardization with Ordnance and is active as a director of the Concinnati Post, which includes southern Ohio, most of Indiana, Kentucky, and Tennessee. He was chairman of the Membership Committee during the past year.

Robert A. Trumpis Elected

The National Board of Governors of the American Society of Industrial Engineers has elected Robert A. Trumpis, as vice-president of the society. The Western Regional Office announces the election of the following officers for 1945: A. H. Petersen, chairman; Prof. Karl F. Venter, vice-chairman; W. W. Rhodes, treas.; A. H. Richards, secy.

New Truck Trailer Program

Since September, the 1945 program for Army truck-trailers has almost doubled and is 20 per cent larger than 1944 production and slightly above the peak in 1943.

Military trailers comprise nearly ten per cent of the army's total automotive vehicle program and range in size from a quarter-ton, two-wheel semi-trailer pulled by a jeep to a 60-ton capacity, full low-bed trailer.

Although some of these trailers are a van type similar to those used for commercial transport, a large number are designed specifically as carriers of chemicals, bombs, bituminous materials, and so forth. Still others are equipped as laundries, laboratories, refrigerators, water purification units, and equipment repair shops.

Recent boosts in requirements are concentrated in four types of semi-trailers, the 20-ton, front-loading, quarter-ton cargo, one-ton cargo, five-ton cargo, and one-ton water tank trailer. The production job on these classifications is especially difficult as new facilities must be obtained or former facilities placed back into production. When schedules were cut back last year many plants turned to other war work.

The most critical production problem is the Army engineers' new 20-ton low-bed, front-loading semi-trailer with dolly (pulled by a 6-ton 6 x 6 truck). It is designed for hauling heavy machinery and equipment over rough terrain and replaces the 20-ton, rear-loading type, of which 3600 were produced last year. The front-loading model has a hydraulic mechanism for lowering the front end to form a ramp. However, tires are the biggest problem. The new model has 17 wheels (eight in the rear, eight on the dolly, and one spare), each requiring a 1400 x 20 high-flotation tire, which means competition with heavy-heavy trucks. These tires are four feet high and weigh nearly 250 pounds each.

Production problems in the 10-ton, two-wheel, stake-and-platform semi-trailer are also critical. This type has been used extensively to carry supplies over the Red Ball Express highway in France.

The increase in the military program necessitated a 15 per cent reduction in commercial trailer allotments in the first half of 1945; only 12,232 are to be produced, as against 14,464 authorized last September. The Truck Trailer Manufacturers Industry Advisory Committee says this won't be enough to meet essential civilian transportation needs.

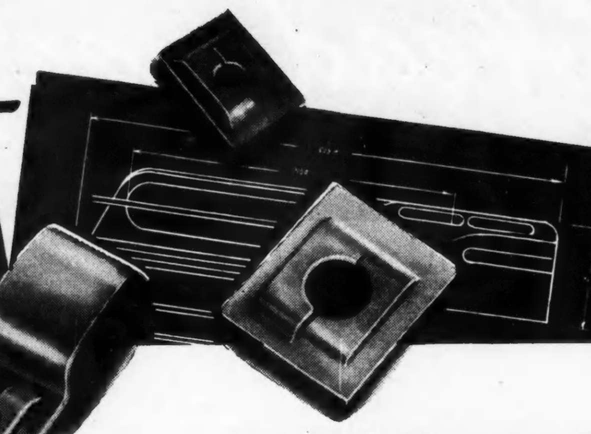
The cutback of the commercial trailer program was made in the general freight trailer category. The general freight trailer program was reduced from 11,248, as authorized last September, to 9016. The authorized programs for the pole and logging type, petroleum and milk tanks, low-bed heavy haulers, off-the-highway and miscellaneous type trailers were not reduced and the program for 1945 approximates the number of trailers authorized for the year 1944.

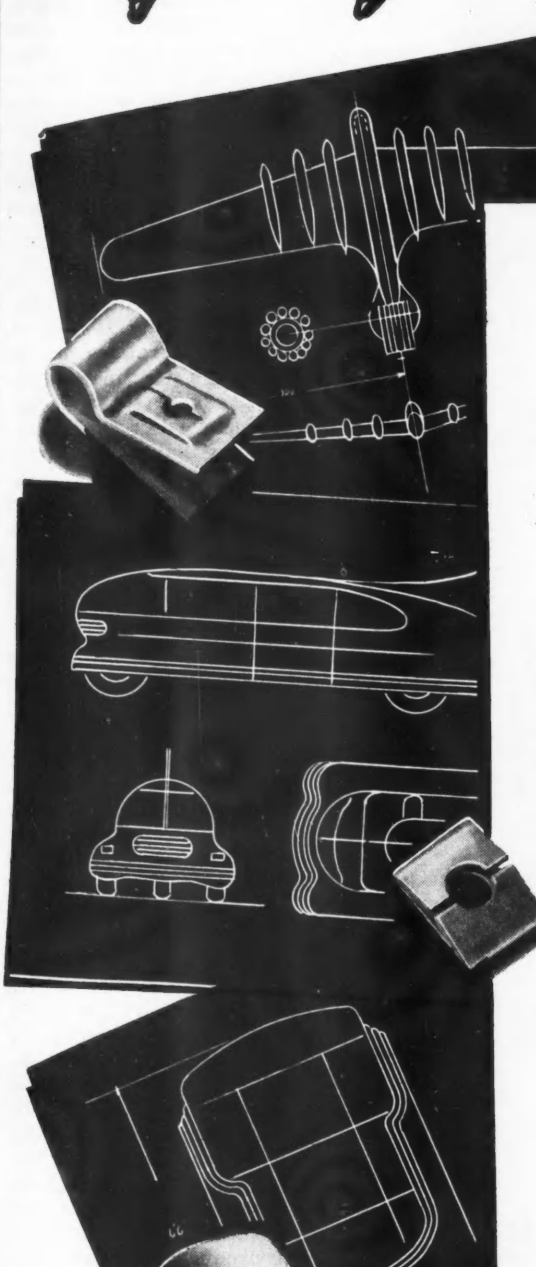
Production of commercial highway trailers reached an all-time high of 50,000 all types in 1941. In 1942, WPB's limitation orders went into effect and only 8400 commercial trailers were built. However, last year's production amounted to 24,092 all types. Today there are some 175,000 general freight trailers (over five tons) operating over the nation's highways.

Cleveland Graphite Bronze Purchases New Plant

Cleveland Graphite Bronze Co. has purchased a plant with 20,000 square feet of floor space and an estimated capacity of 1.5 to 2 million engine bearings a month at Bridgeport, Ohio. The move was made because manpower to operate needed additional capacity was not avilable in Cleveland, according to James L. Myers, vice president, and machinery which has been standing idle has been moved. The new plant will employ 250 to 300 persons when at full capacity.

Design Engineers—





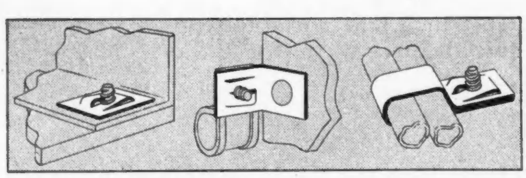
...put STALOCK*

into your blueprints now

STALOCKs* save time and money by speeding flow and lowering assembly costs. Self-locking ... resilient ... re-usable. Eliminate lock washers and bearing washers. Light in weight. Full 360° contact with screw threads—that's why they're called "the all around fastener†." Give a better grip than fasteners having only limited contact. Wide variety of types and sizes for fast-acting sheet metal screws. SEND FOR CATALOG—Address Stalock Fastener Division, Dept. N-501.

STALOCK* PUSH-ON—Supplant screws in your fastening assembly with metal and integral plastic studs and use STALOCK* PUSH-ONS to effect even greater speed and lower costs. Fasten and lock with finger pressure. Maximum holding strength, yet lift off easily for product service or repair.

*Trade Mark †Pat. Pend.



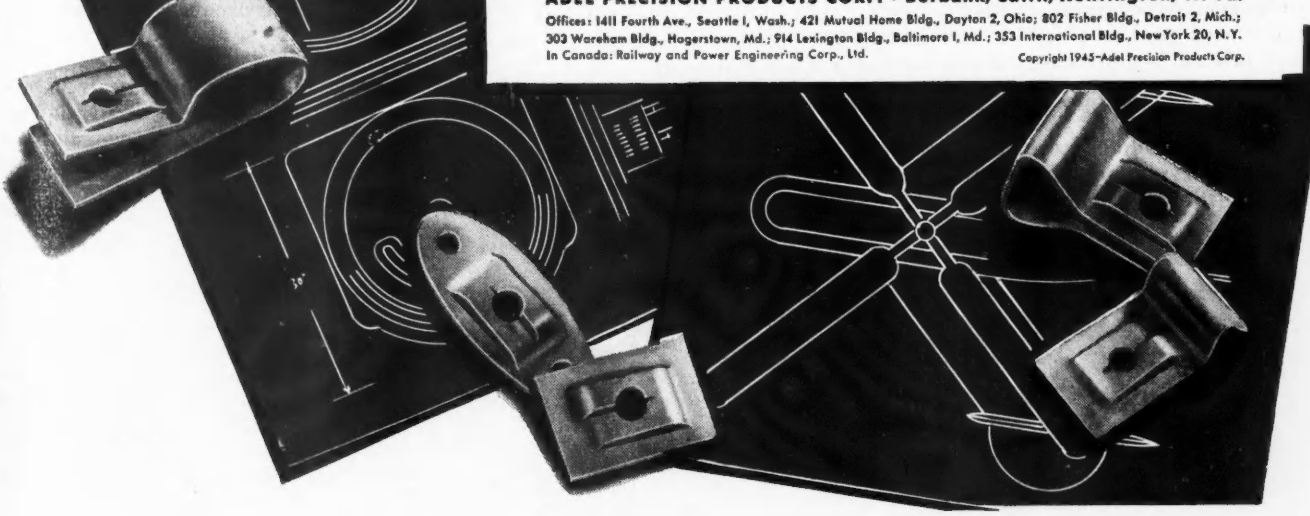
STALOCK*, "the all around fastener†," has all-'round applications for fast cost-savings product assembly. Here shown (left to right) are the flat type, angle bracket type and integral loop type clip.

ADEL

Trade Mark

ADEL PRECISION PRODUCTS CORP. • Burbank, Calif., Huntington, W. Va.

Offices: 1411 Fourth Ave., Seattle 1, Wash.; 421 Mutual Home Bldg., Dayton 2, Ohio; 802 Fisher Bldg., Detroit 2, Mich.; 303 Wareham Bldg., Hagerstown, Md.; 914 Lexington Bldg., Baltimore 1, Md.; 353 International Bldg., New York 20, N.Y. In Canada: Railway and Power Engineering Corp., Ltd.



Synobel May Be Standard Finish for British Cars

VARIOUS British automobile manufacturers are now testing the long-term weathering capabilities of a new body finish known as Synobel, a product of Imperial Chemical Industries. They have been convinced of its superiority over both cellulose lacquers and synthetic enamels in other respects, according to the British correspondent of AUTOMOTIVE AND AVIATION INDUSTRIES.

Its appeal is increased by the fact that it is applied by normal production methods with only slight modifications of existing equipment. It dries almost as quickly as cellulose and has the beauty of a synthetic enamel finish. An outstanding advantage is that, following smoothing operations on the preliminary coatings, the final coat requires no rubbing down or polishing; its high gloss, mirror-like surface and brilliant lustre are gained by baking. Moreover, in the event of accidental damage to the surface during either production or use, the blemish can be removed without difficulty.

Owing to the reduction of smoothing operations on preliminary coatings and the complete elimination of final polishing, the durability of the finish is enhanced by the fuller, deeper and more protective film.

The process is summed up as follows: One coat of primer is sprayed on and air-dried for 15 min. Then two coats of surfacer are sprayed on with a 15-min. interval between them. The work is then baked for 60 min. at 250 deg. F. This is followed by smoothing with fine, wet abrasive paper and spraying with a sealer; the latter is force-dried for 20 min. at 150 deg. F.

Then follows the application of the actual "Synobel" enamel. Two coats are applied with a short interval for "flashing" (i. e., dispersal of the solvent) and a force-dry for 20 min. at 150 deg. F. The work is then lightly "flatted" with wet abrasive paper, this being followed by the final flow process in an air-conditioned oven at 250 deg. F. for 30 min. It is by this final operation that the mat-surfaced film is "reflowed" to produce the high gloss and lustre.

The process of "reflowing" also enables damage to the surface to be easily repaired. The area of the damage is flatted to a feather-edge and the enamel applied only locally where required. It is then force-dried, a suitable source of heat in this case being a radiant heat lamp.

New Agent for LeBlond

Mr. B. N. Brockman, general sales manager, The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, announces the appointment of the Ford Machinery Co., Toledo, Ohio, as the agent for the complete line of LeBlond lathes, Regal lathes and cutter grinders for the Toledo territory.

"IMPROVEMENT...the key," *he says*

LOOK, "L.G.", how recourse to Lincoln arc welding improves aircraft fabrication:

LINCOLN "PLANEWELD"

...the key to better aircraft at lower cost

Users report that this Lincoln Electrode improves the welding of SAE 4130 and X4130 steel these ways:

Simplifies arc handling . . . Quiet, smooth arc . . . easy to start and easy to maneuver. Extremely stable even at very low current values.

Gives excellent fusion . . . Gets into corners. Washes up well on sides of joints. Makes extremely smooth, sound welds.

Fabricating engine mounts with Lincoln "Shield-Arc Jr." Aircraft Welders and "Planeweld" Electrodes.

Full details and procedures given in the "Weldirectory," Bul. 402. Free on request.

THE LINCOLN ELECTRIC COMPANY • DEPT. Z-1 • CLEVELAND 1, OHIO

America's greatest natural **recourse**

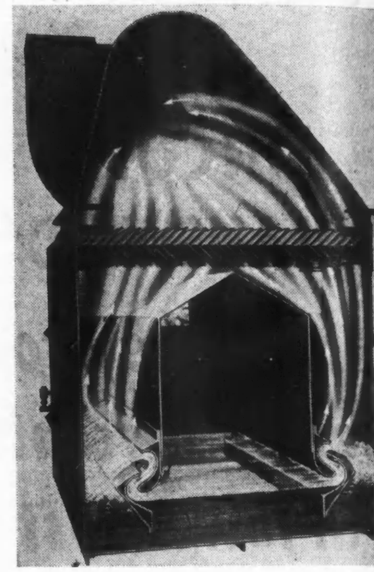
ARC WELDING

New Products

Dust Collecting Equipment Has No Moving Parts

The latest addition to the Roto-Clone series of dust collecting equipment made by the American Air Filter Co., Inc., Louisville, Ky., is the type "N" based on the principle of hydrostatic precipitation. The absence of moving parts is said to make it ideal for the safe control of magnesium and explosive dusts, the collection of linty and adhesive dusts from buffing operations, and the exhaust of corrosive gases.

The air is cleaned by a combination of centrifugal force and intimate intermixing of water and dust laden air. The air, forced through the sinuous passage of the stationary impeller, induces a heavy sheet of water to move along the surface of the impeller blades creating a water curtain in the form of a reverse "S" through which the air



Type N Roto-Clone dust collector

must penetrate. The high collection efficiency is the result of the impingement of the dust in water due to the centrifugal action in the impeller and the scrubbing action of the water curtain which permits returning the clean air to the workroom.

The Type "N" Roto-Clone is manufactured in three classes and thirteen sizes for the exhaust of from 1000 to 25,000 cfm of air.

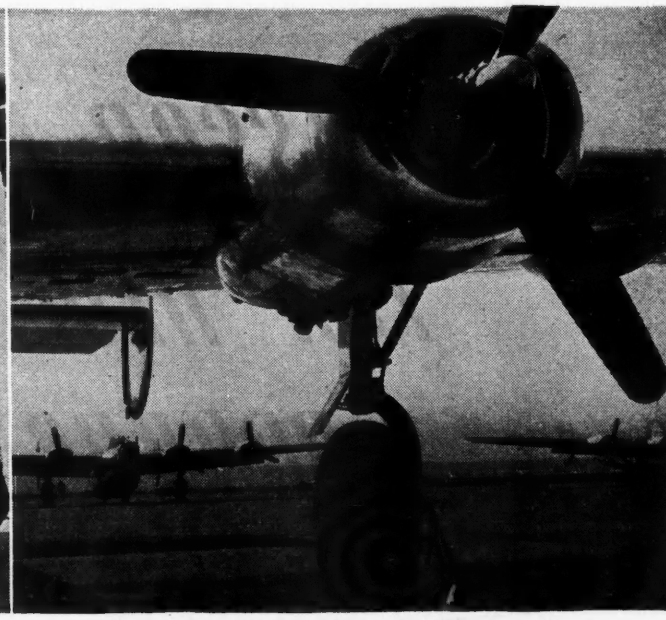
Portable Insulation Tester

A small portable insulation tester that can be plugged into any 115-volt, 60-cycle outlet, and capable of supplying smooth variable test voltages from 0 to 2500 volts, has been brought out by the General Electric Company,

(*Turn to page 132, please*)

G-E portable insulation testing set

Boeing B-29—Hayes Dual 56" Wheels and Dual Expander Tube Brakes.



Consolidated B-24—Hayes 56" Wheels and Dual Expander Tube Brakes.

Curtiss C-46—Hayes 19.00-23 Wheels and Expander Tube Brakes.

Piper L-4—Hayes 8.00-4 Wheels and Expander Tube Brakes.

WHATEVER THE JOB . . .

Missions - sorties -*"recco"*- liason - transport or training . . . land- and carrier-based flying begins and ends on wheels.

And on thousands of aircraft - military, naval, air-line and civil - Hayes Wheels and Brakes are standard. Whatever the factors - weight-saving; higher loadings and landing speeds; maintenance simplicity; efficient heat dissipation; freedom from fading, grabbing, warping - they're engineered and built into Hayes performance, service-tested and proved under world-wide conditions.

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Wheels and Brakes

Western Representative: Airsupply Co., 5959 W. 3rd St., Los Angeles 36, Calif.

HAYES INDUSTRIES, INC. Home Office: JACKSON, MICHIGAN, U. S. A.

Schenectady, N. Y. The set has a capacity of 750 va and will stand one-minute loads of 1500 va without injury. It can be used to test electric apparatus ranging from the wiring for small appliances to Diesel-electric locomotives up to 600 hp.

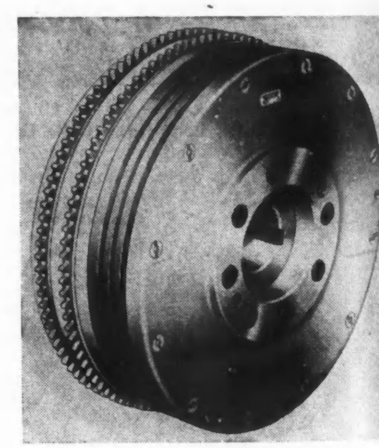
The complete set, compactly built into a small steel case, consists of a dry-type, step-up transformer, variable autotransformer for smooth voltage control, indicating voltmeter, air circuit breaker with instantaneous overload trip, and control switches. Two 15-ft shielded test cables, one with an insulated test handle and the other with a spring clip for grounding one side of the high-voltage circuit, and a 15-ft supply cord with a connecting plug and ground clip, are also provided. The entire unit weighs 47 lb, including the crackle-black enameled case measuring 15 by 7¾ by 8¾ in.

Air-Actuated Clutch

The Twin Disc Clutch Co., Racine, Wis., is introducing a new clutch known as the Model P air-actuated clutch. It retains many of the features of the heavy-duty Twin Disc Model E (friction) clutch and may be used in many of the same types of installations as the latter clutch.

The Model P has a hub and back plate, center plate, floating plate and friction discs of essentially the same proportions as the Model E, and is manufactured in a wide range of sizes, from 14 in. to 36 in., and capacities, 65 to 895 hp.

The air-actuated clutch operates by remote control without a complicated

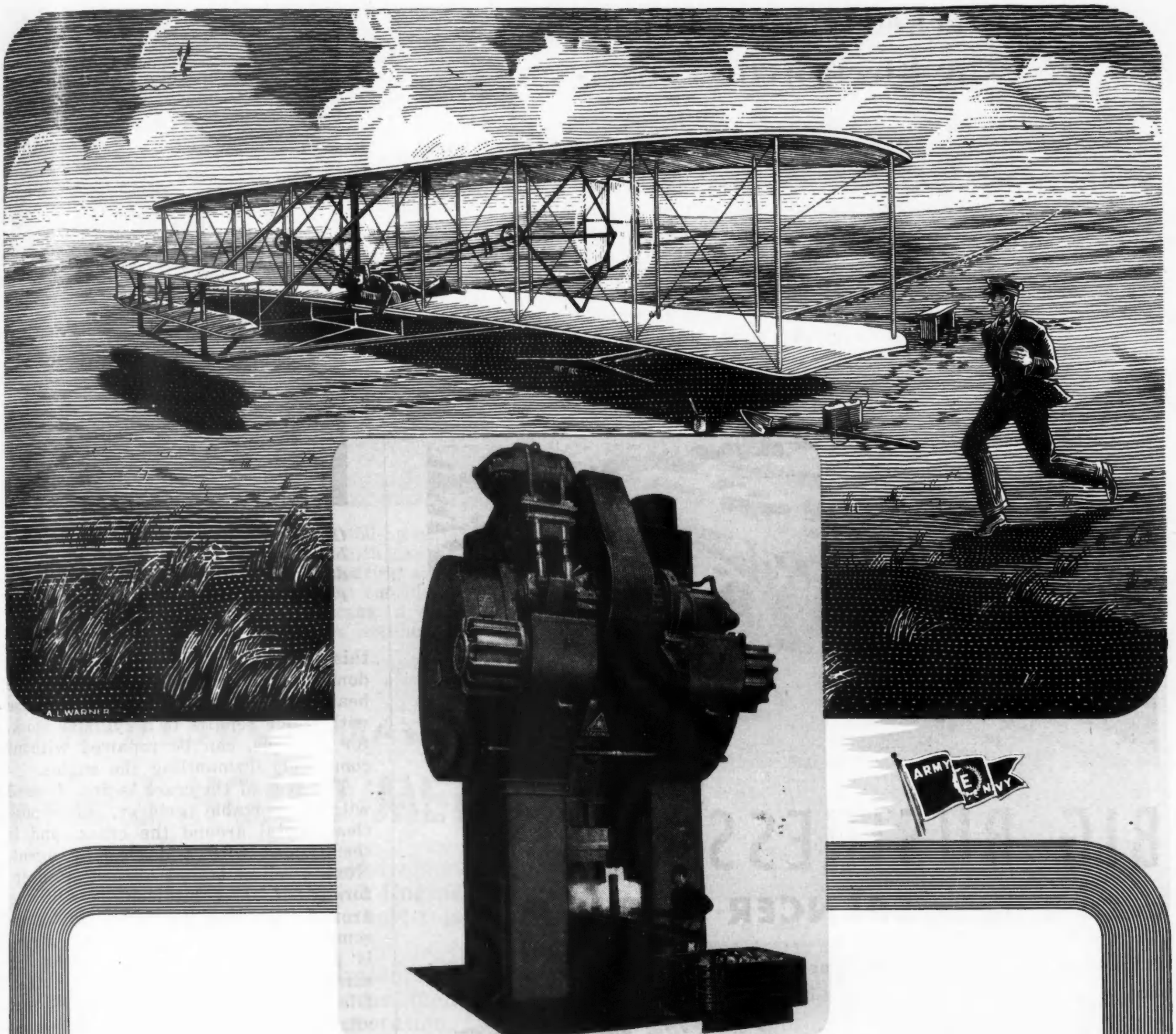


Model P air-actuated clutch

linkage system, and shaft space is greatly reduced. It is said to have ideal operating characteristics because any amount of air pressure—within limits—can be applied to the friction plates to provide either slow or fast engagement. Few moving parts are employed to assure easy maintenance.

The Model P design provides two different methods for handling the actuating air supply, depending upon where the clutch is mounted: First, by drilling

(Turn to page 152, please)



THEY DIDN'T INVENT IT!

History records many heavier-than-air flying machines. But stability in the air, to make powered flight practical, is something else again. That's where the Wright brothers succeeded in analyzing a baffling problem and solving it with the ailerons that distinguished their machine.

Presses for forming metal have a relatively long history too. It took the first Clearing press, though, to point the way to new concepts of what presses could do and how they should be built. Practical results of those ideas are faster work cycles, greater ease and economy of operation and maintenance of closer tolerances than were formerly considered practical in stamping.

Today it will pay you to tell Clearing what you would like a press to do for you. Investigate the cost-reducing possibilities of Clearing presses now. See how their adaptability to a wide range of products, materials and installation requirements has been able to solve so many "can't be done" press problems. Your inquiry entails no obligation, so write today. Clearing Machine Corporation, 6499 West 65th Street, Chicago 38, Illinois.

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MECHANICAL AND HYDRAULIC PRESSES

FOR SUCH OPERATIONS AS DRAWING ★ BLANKING ★ FORMING ★ FORGING

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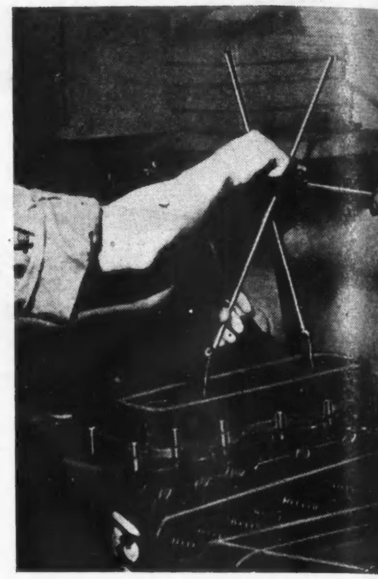
Cracked Castings Repaired by Electrolytic Process

In the monthly *Production and Engineering Bulletin*, issued jointly by the British Ministries of Labor and Production, particulars have been released of a process of repairing cracked castings by electro-deposition. It is stated to have been in use in England during the past two years or so on a commercial basis. The results obtained have led to the process being placed on the "approved" list of the Ministry of Supply.

Hitherto, the process has been applied chiefly to the cylinder-block castings of engines of the automobile type, but it is equally suitable for application to castings of any kind, large or small, provided repair is justified by complexity of construction and high replacement cost. It is essential in all cases, however, to take account of the degree of stress to which the repaired area is likely to be subjected in service.

Several advantages are claimed for this process, among them being freedom from the risk of distortion by the heat of a welding repair and the ease with which repairs to a cylinder block, for example, can be repaired without completely dismantling the engine.



One of a row of cracked cylinder blocks under repair by the electro-deposition method. Shown in this photo is the bitumen cell formed around the area of the crack.

The area of the crack is first dressed with a portable grinder, to expose clean metal around the crack, and is then wiped with a degreasing agent. Next, a cell or trough about 2 in. deep, formed of sheet bitumen, is built up around the crack, as shown in the accompanying illustration, and the crack is plugged with plaster of paris, or similar material. The trough is then filled with a mixture of sulphuric and nitric acids, a lead cathode is immersed in the fluid and the casting is connected to the positive power lead. On the passing of current through the electrolyte, the cleaned surface is anodically etched.

Removal of the acid solution follows and the trough refilled with a nickel-plating solution. A nickel, instead of a lead electrode, is then made the anode and current is passed through the circuit for about 30 min. to deposit a thin coating of nickel on the surface around the crack. At the next stage, a deposit of copper (approximately 0.005 in. thick) is applied over the nickel film by removing the nickel-plating solution and replacing it with an acid-copper solution, and using a copper anode.

Subsequent stages involve (a) the temporary removal of the copper solution and dusting brass powder on a fresh filling of plaster of paris in the crack to make it conducting; (b) scouring the plated surface with pumice; (c) replacing the copper solution; and (d) continuing deposition of copper until a film approximately 0.1 in. thick has been formed. The trough is then removed and the copper deposit trimmed up.

These carburized parts for the Jacobs 450-hp aircraft engine show some of the heat-treating problems which can be simplified when Homo Methods of carburizing and tempering are used. In the ring gears, distortion-prevention is the main consideration; in the clusters, uniform case is vital; in the crank, a principal problem is depth of case; in the liners, maximum hardness is required. And, always, smooth surface is obtained.

LOW-REJECT HEAT-TREATING BY THE 3 HOMO METHODS

In planning their production of trainer-plane engines at Plant Two, the Jacobs Aircraft Engine Co. of Pottstown, Pa., deliberately set out to hold rejects down to a record-making "low".

Production records and equipments in other plants were investigated, and when Jacobs finally settled on a certain way of performing an operation, they knew in advance what results to expect.

So, there has been little surprise over the performance of the Homo Method equipments for carburizing, nitriding and tempering; but the results definitely speeded up our country's supply of trainer-plane engines, at a time when it can be said without exaggeration that these engines were desperately scarce. For the engine parts entrusted to Homo Methods are heat-treated exactly as specified; heat-treatment runs for days at a time, with tens of thousands of parts handled without a reject. In the Homo Nitriding Furnace, no piece has ever been rejected. And the 100% inspection is particularly severe, because Jacobs stresses the long service which engines give before repairs are necessary.

The Homo Methods are described in detail, with many pictures, in our various Catalogs, sent on request. For Homo Carburizing, ask for Catalog T-623; for Nitriding, T-624; for Tempering, T-625.

V depends on me!
A Slogan For Every American

Jrl Ad T-620(18)

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MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Homo Tempering Furnaces Being Unloaded

Unloading A Homocarb Furnace Full of Large Shafts

No Part Homo-Nitrided Here Has Ever Been Rejected

Recommendations for the Use of Diamond Turning and Boring Tools

A shaped diamond tool consists of a polished diamond edge, with accurate cutting angles; the diamond is set rigidly into a steel holder or shank (Fig. 1). The special method is to have only one cutting edge in operation at a time, thus geometrically correct surfaces are produced.

The tool edge itself may be adjustable or may have several cutting edges in order to utilize the material better, but only one cutting facet or a part of the cutting edge is in operation.

Shaped diamond tools are precision tools and should be handled in the same way as measuring gages, micrometers, etc. When not in use the tool should be kept in felt-lined box (Fig. 2) or the cutting edge of the diamond should be protected by cotton wool or a small piece of rubber hose.

Fig. 1 (below).

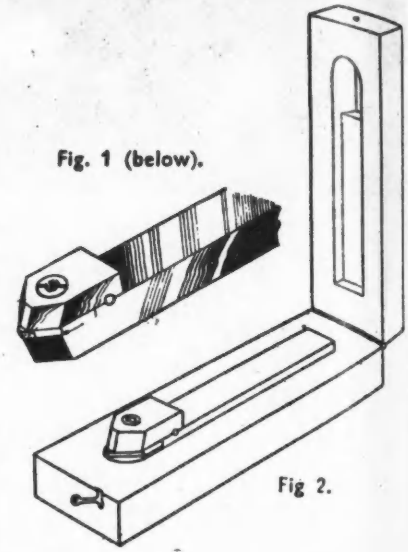


Fig 2.

The machines used for turning and boring should be absolutely rigid and should run practically without vibration. It is essential that the machines rest on a solid foundation, sometimes it is desirable to provide means for damping the vibration from other sources. The driving motor should be mounted separately and drive the spindle through flexible couplings or by endless belts. The spindle should be well balanced; the bearings should be

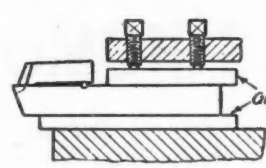
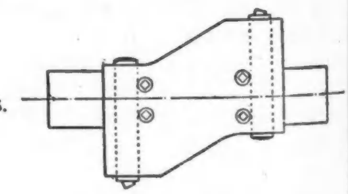


Fig. 3.

properly fitted and be free from radial or end play. Many users prefer plain bearings, but preloaded precision ball bearings also are employed.

Turning and boring tools should be clamped rigidly in the tool holder or boring bar. The shanks of rectangular tools are usually ground to provide a

Fig. 4.



good support between the mating surfaces. The tool should be fitted with the smallest possible overhang in order to avoid any springing and to reduce bending deflection (Fig. 3).

Rotating tools such as boring bars cutter heads and milling cutters equipped with diamond tips must be properly balanced (static or dynamic). Tool bodies should be designed in symmetrical form (Fig. 4).

Simultaneous using of sintered carbide tool and diamond is not recommended; only after the carbide tool has left the cut, should the diamond come into action (Fig. 5).

The point angle should be, if possible

(*Turn to page 138, please*)

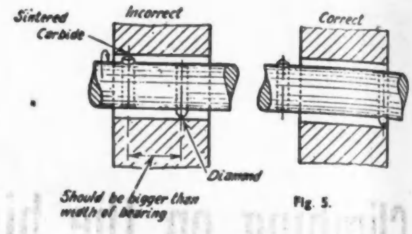


Fig. 5.

120 deg for straight machining. In general for a diamond with only one cutting edge a point angle ϵ larger than 90 deg is selected (Fig. 7a). A good tool shape is a large circular form, providing an infinite number of cutting facets (Fig. 7c) which can be utilized if any part of the tool edge has become blunted or worn. Practically the same advantages can be claimed for the multiple facet diamond (Fig. 7b), which has an included point angle of about 170 deg.

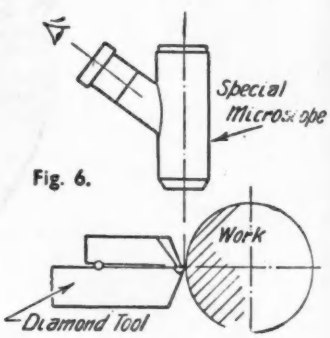
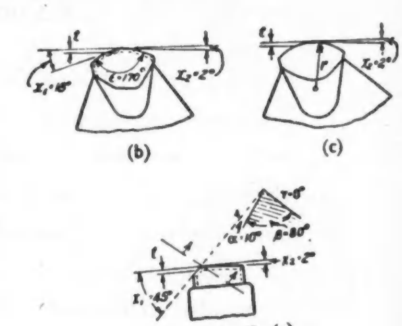


Fig. 6.

The side adjusting angles are of great importance with regard to the surface produced; the front adjusting angle κ_1 being usually 45 deg on tools with one cutting edge and 30 to 18 deg in multiple facet tools. The rear side adjusting angle κ_2 is 1 to 2 deg. The clearance angle α is selected as small as possible in order not to reduce the tool angle β too much.



(b) (c)

Fig. 7 (a)

The relatively small clearance angle necessitates an accurate height adjustment (preferably 1/100th work diameter above center height) (Fig. 8d). Form turning tools have always to be adjusted on center height. Height adjustment is facilitated as top rake is usually zero; some materials such as lead or bronze, have negative rake angles.

The sidewise adjustment is of great

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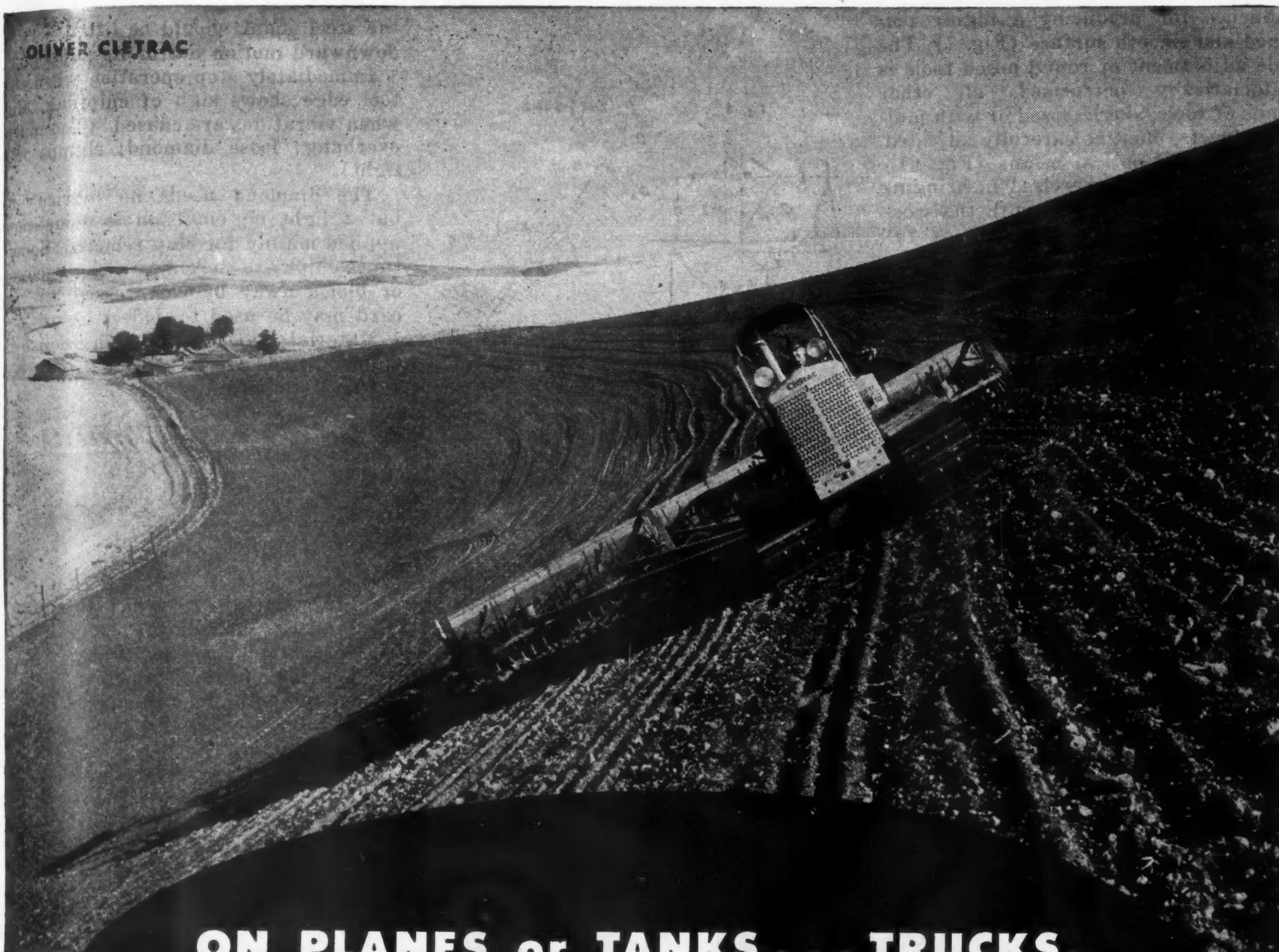
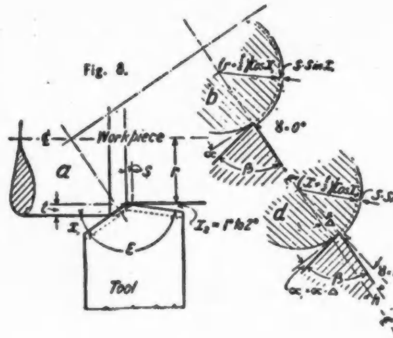

OLIVER CLETRAC

influence for producing a highly polished and smooth surface (Fig. 7). The side adjustment of round nosed tools is automatically performed, all other kinds of tools, single nosed or with multiple facets, must be carefully adjusted, preferably by optical means (Fig. 6).

Care should be exercised in bringing the tool edge in contact with the work when this is already rotating at full speed. Stopping the spindle when the tool is in contact with the work should be absolutely avoided as well as interrupting the feed. Withdraw the tool first, then stop feed motion and at last spindle rotation.

If the spindle is accidentally blocked,



the steel shank should be lifted with a downward motion out of its support.

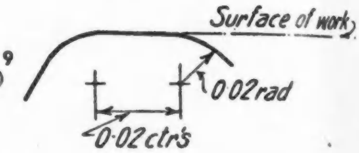
Immediately stop operation when the tool edge shows sign of chipping, and when vibrations are caused. (Too much overhang; loose diamond; clamps not tight).

The diamond needs no lubrication, but a light oil emulsion is sometimes applied mainly for chip removal. Sometimes chips are sucked away by vacuum or blown away by compressed air A card may be used to deflect chips.

Materials machined with polished diamond tools are:

(a) Metallic Materials:

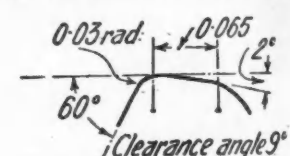
Fig. 9 (a)



Light-metal alloys: aluminum, magnesium alloys;
Soft metals: copper, brass;
Bearing metals: babbitt metal, bronze and lead bronze;
Precious metals: gold, silver, platinum;
Cast iron and steel: only in special cases.

(b) Non-Metallic Materials:
Phenolformaldehyde plastic: bakelite with cotton or fiber fillers;

Fig. 9 (b)



Cellulose-acetate plastic: ebonite (for instance, fountain pens);
Carbon: brushes for electric motors.

Cutting speeds should be as high as possible. The lowest range for a safe and economic operation of diamond tools is about 200 to 300 fpm. The upper limit is fixed by the freedom of vibration in the machine.

Very fine feeds are useful to obtain smooth and bright surfaces from which the side facets of the diamond cutting edge have removed nearly all ridges.

Indications for the economical selection of cutting speeds are given in the following table.

Material	Cutting-speed feet per min.
Tempered cold workable aluminum alloys	650 to 1,000
Pure aluminum	1,500 to 1,800
Magnesium alloys	1,000 to 1,250
Bronze	500 to 1,000
Lead-bronze	1,650 to 1,000
White metals	800 to 1,150

Optimum results in surface finish (down to 1 micro-inch = 0.000.001 in.) have been obtained with the tool form (Fig. 9a) on aluminum pistons. Good results are also obtained with the tool edge (Fig. 9b).

Reprinted from "Industrial Diamond Review."

BOOKS . . .

AIRCRAFT ARMAMENT, *by Louis Bruchiss,* contains practically all the important information on the subject indicated by the title thus far released, it being understood, of course, that during a time of war there are considerable data which cannot be published for reasons of national security. The manuscript was examined by government officials and approved for publication. Technical data on some of the most recently publicized developments in the field of aircraft armament not appearing in the book are undoubtedly considered in the restricted category by military authorities. Aside from specific treatises such as government manuals on guns and ammunition, this book represents the most complete compilation of material dealing with aircraft armament that has been made available in a single volume.

Published by *Aerosphere, Inc.,* 370 *Lexington Ave., New York, N. Y.*

"THE MODERN GAS TURBINE," by *R. Tom Sawyer. Pub. Prentice-Hall, Inc.,* 216 *pp.* Jet propelled military airplanes which made their appearance so dramatically in World War II served to whet the interest of engineers and the public alike in the possibilities of the gas turbine. The conception of the gas turbine is not new. Curiosities of literature, as cited by the author, show applications made in the middle ages. Attempts to build gas turbines were made in the 19th century and continued into the dawn of the 20th century but met with scant success owing to the limitations of the then known metals.

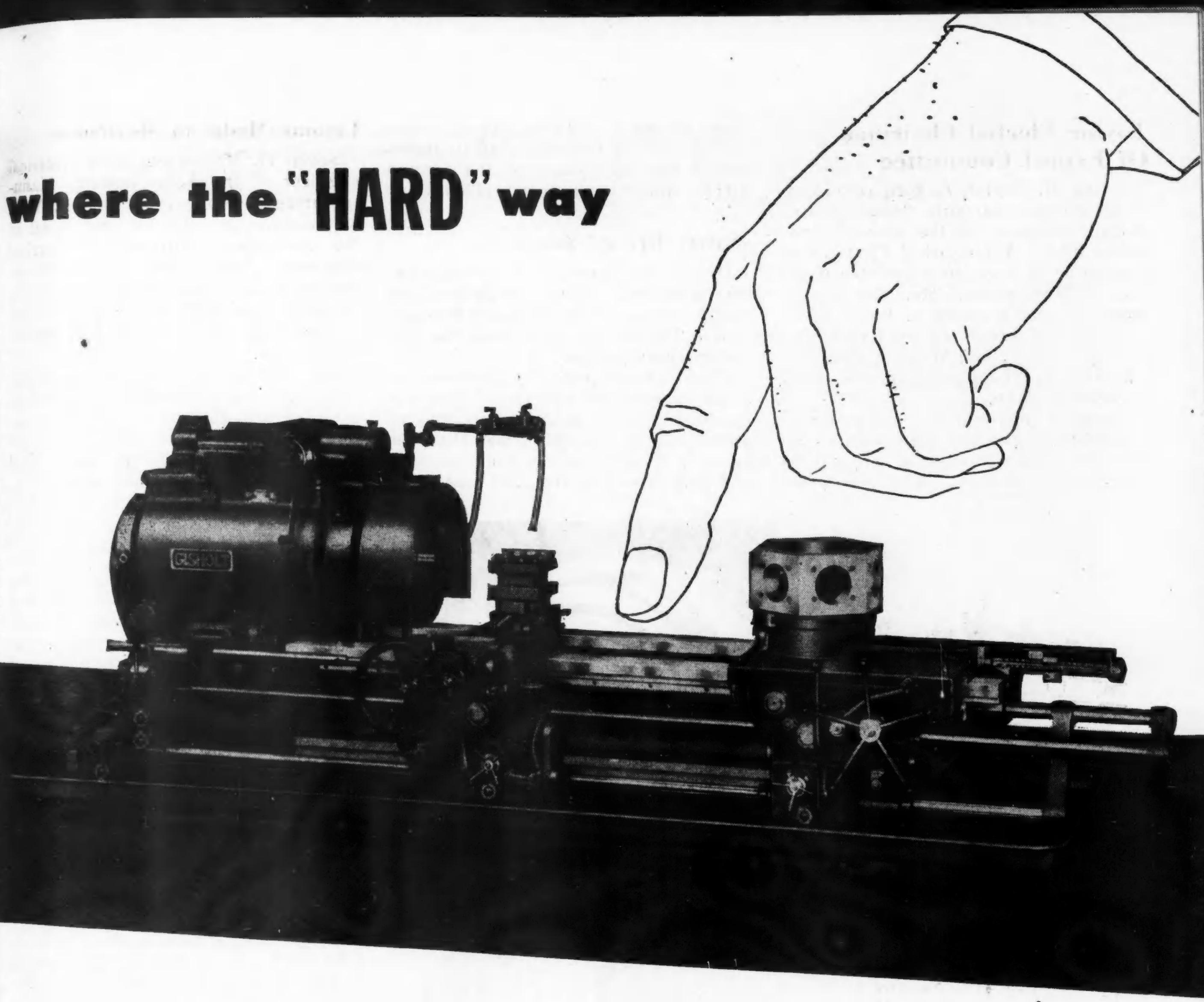
In this new book the author, who is a keen student of the subject, has presented a comprehensive picture of the development of the gas turbine up to the present time. Fortunately, the presentation is succinct and free from the usual complications of fundamental mathematical analysis, thus lending itself to quick and easy reading by the engineer or the layman.

The reader is referred particularly to the chapters dealing with the gas turbine using Diesel exhaust gases as a supercharger or as a prime mover; and the discussions of exhaust superchargers on aircraft engines. These applications appear to offer considerable promise for automotive applications in motor vehicles, airplanes, and marine installations. Engineers and designers will profit by the brief summary on combustion gas turbine calculations and efficiencies in Chapter V; and other cycle analyses which appear in the chapters on the gas turbine in industry and in locomotives. These analyses are presented in concise and simplified form and provide an excellent appreciation of the technical aspects of the subject.

The bibliography in Appendix I provides the most up-to-date listing of pertinent references to available literature and should be of invaluable help to the student of the subject.

AIRFRAME MATERIALS, *by F. S. Stewart,* 237 *pp., Pub. McGraw-Hill Book Co.* Here is an introductory textbook on the materials used in the construction of airframes. It is intended to familiarize the reader with the structural materials in use today; also to compare the properties of the newly developed plastics with those currently in use. Among the chapters of the book are sections on the following: heat treatment of steel, aluminum alloys and magnesium alloys, cleaning and chemical treatment, bonding processes, casting and forging of aluminum and magnesium, veneers and plywood, sealing processes, plastic compositions and transparent plastics.

where the "HARD" way



is the RIGHT way!

There is no substitute for *hard* steel on the ways of a turret lathe. That's why Gisholt does it *right* . . . makes its bedways of steel, hardened to 64-66 on the Rockwell C scale.

That's why Gisholt's ways can't be battered by heavy work or scored by hard, tough chips. Straddle-keyed their entire length, bolted to bedways from the under side, and finish-ground in exact alignment with the spindle, Gisholt's hardened-steel ways provide bearing surfaces that are virtually wear-proof. They insure the high standard of accuracy for which Gisholt is known —and maintain it through long years of service.

Gisholt's thick, block-type ways are hardened on all surfaces: (1) *top to support weight of carriages and cutting pressure of tools,* (2) both sides *for alignment and gibbing, and* (3) *for* bottom *gibs and clamps. Automatic pressure lubrication eliminates any tendency to wear, even in areas of heaviest carriage travel.*

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GISHOLT

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

Taylor Elected Chairman Of Export Committee

Irving H. Taylor, eastern representative, Douglas Aircraft Company, was elected chairman of the Export Committee of the Aeronautical Chamber of Commerce at a recent committee meeting in Washington. Mr. Taylor succeeds the late Howard S. Welch.

Joseph M. Barr, manager, Export Department, Pratt and Whitney Division, United Aircraft Corporation, was elected vice-chairman.

Overseas disposal of surplus war property was cited by the committee as the most serious problem affecting postwar export markets. The committee voted to add a full-time export representative to the Chamber staff to undertake a thorough study of the foreign surplus and other export problems.

Safety Record Zooms

Despite the addition of an unprecedented number of new employees, the safety record of the Studebaker Automotive Division in 1944 was the best within recent years.

Figures made public by the company today showed the frequency of accidents (number per one million manhours of work) was 45 per cent lower than the previous year and accident severity was only one-third the 1943 rate.

Lamme Medal to Mortensen

Soren H. Mortensen, chief electrical engineer of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., will receive the 1944 Lamme Medal of the American Institute of Electrical Engineers. This medal is awarded annually to a member of the Institute in recognition of high achievements in the development of electric apparatus or machinery.

Mr. Mortensen receives the medal "For his pioneer work in the development of self-starting synchronous motors and for his contributions to the development of large hydraulic and steam turbine driven generators."

James Lincoln Ashley

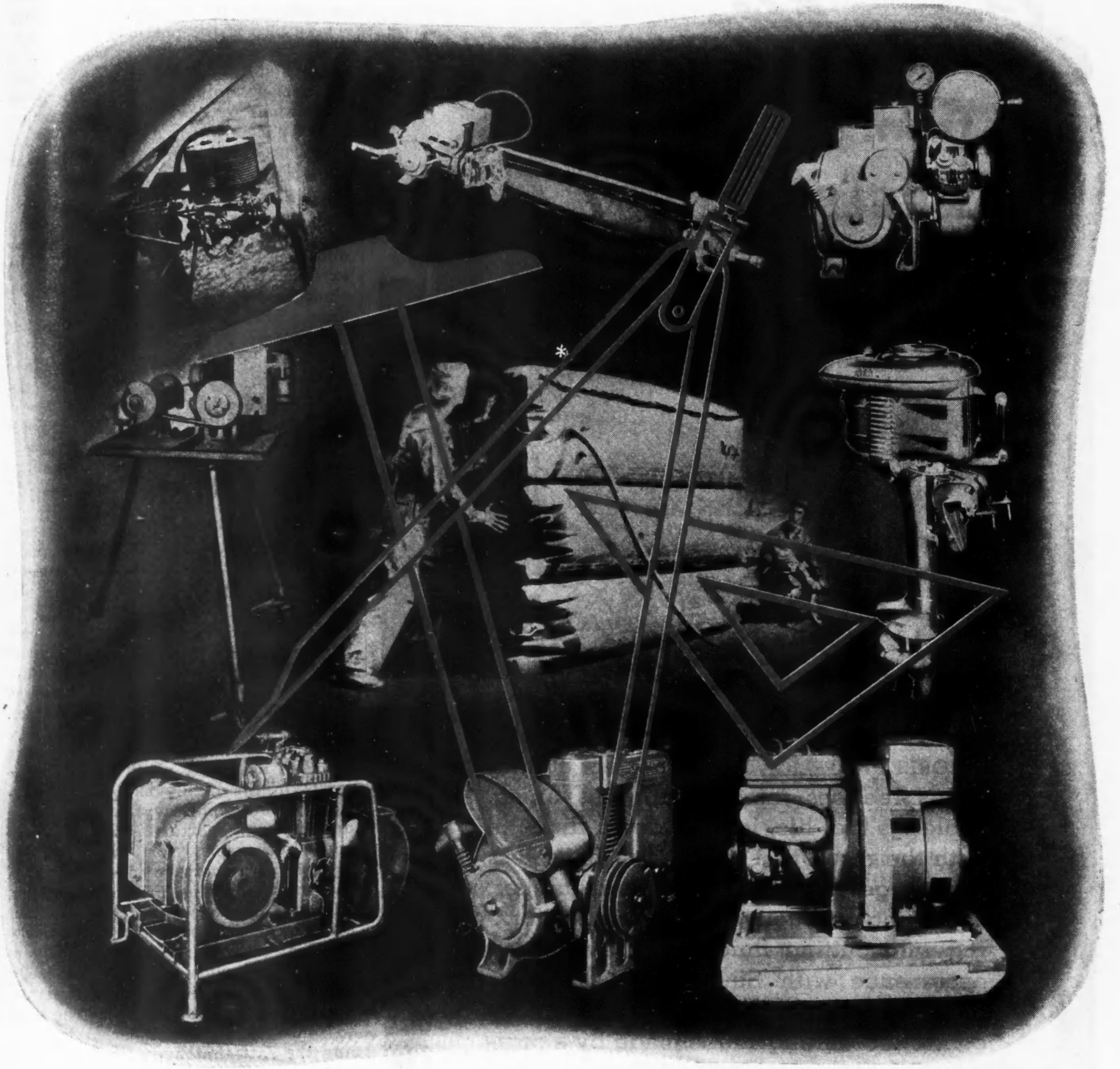
James Lincoln Ashley, 75, a director of The International Nickel Company of Canada, Limited, died suddenly March 6 in New York. Mr. Ashley was formerly secretary and treasurer of The International Nickel Company of Canada, Limited and vice-president and treasurer of The International Nickel Company, Inc., the United States subsidiary.

Objective of WPB is All-Time High Production Rate in June

(*Continued from page* 106)

Plan has almost been wrecked by overriding directives calling for special orders of steel. Under CMP, mills are allotted monthly schedules, with the first 15 days of the following month allowed for catching up on carryovers. However, the granting of special directives with top priorities has so botched up scheduled deliveries that the carryover now averages nearly a full month's production. Add to this confusion, the further complications of drafting of men 26 to 29, possibilities of heavy spring floods in the steel producing centers of the eastern U. S., the critical situation in refractories, and the trend toward special specifications which call for special preparations and treatment, and the outlook is definitely on the dark side.

Machine tools also continue to be troublesome in some of the critical programs. Equipment for the heavy artillery program now is more than a month behind schedule and it may take until May to catch up. Machine tools for shell manufacture are expected to pull heavily on the machine tool industry, as will those for the recently expanded truck and tank programs. If present forecasts materialize, orders for about $300 million worth of machine tools are expected to pile on top of the $187 million in unfilled rated orders now on the books. This would require the capacity of the industry for the entire year at the present rate of production. Of course, it should be remembered that



* PHOTO BY AIR TECHNICAL SERVICE COMMAND

Yesterday . . . Today . . . Tomorrow . . . Kiekhaefer engineering sets the pace for 2-cycle engines. Keep looking to Kiekhaefer for leadership.

ARMY E NAVY ARMY E NAVY ARMY E NAVY

KIEKHAEFER CORPORATION • CEDARBURG, WISCONSIN

BUILDERS OF GASOLINE ENGINES EXCLUSIVELY

MERCURY

Outboard Motors • Marine Engines • Portable Industrial Engines • Aircraft Engines • Aircraft Auxiliary

Built to Use Built to Last

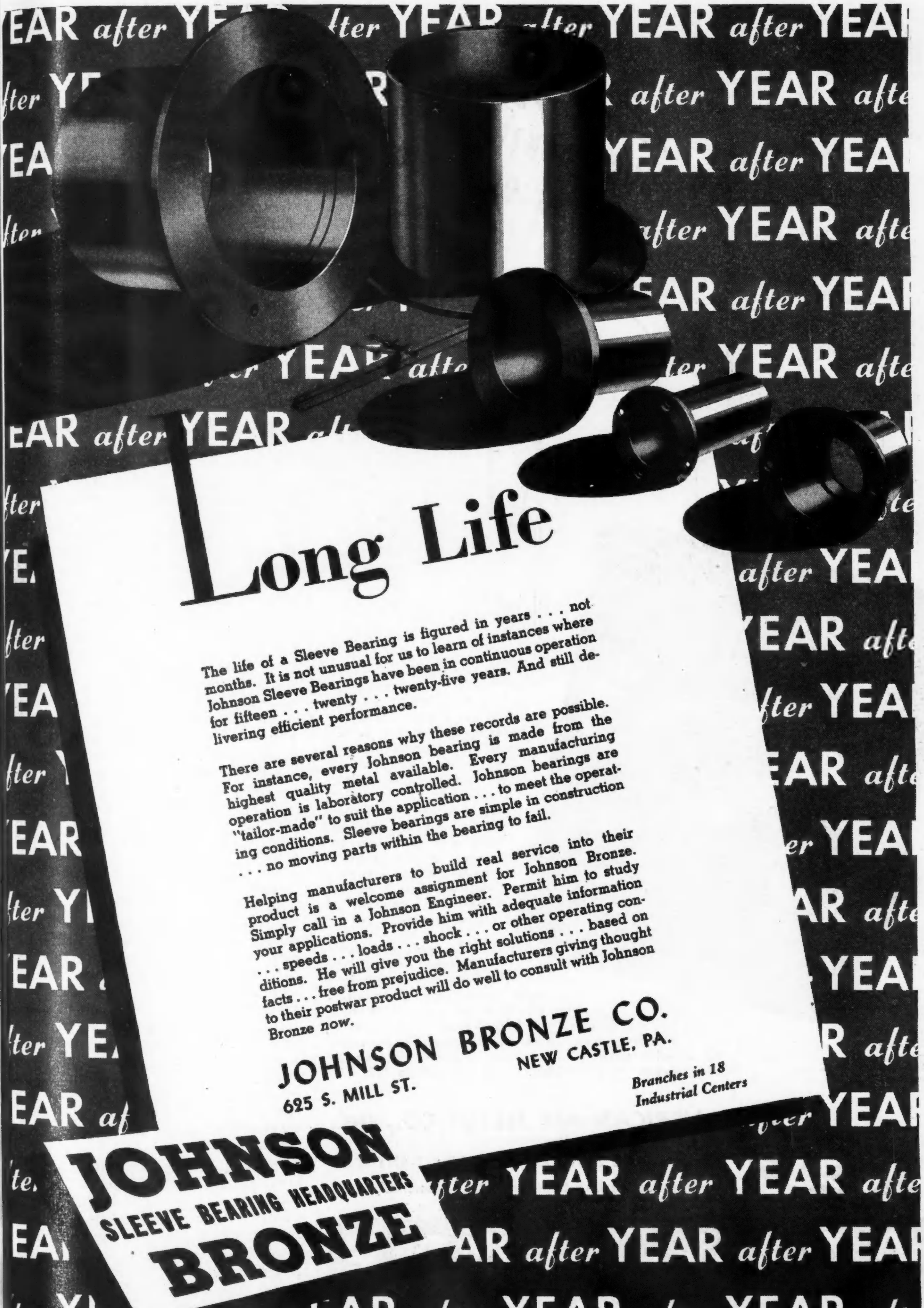
if the war in Europe should end, orders probably would be severely cut back. There also is the possibility that more tools than expected may be found in surplus stocks or among those released by cutbacks during the year. However, the outlook for obtaining any machines in preparation for resumption of civilian production is practically hopeless at this writing.

Still more war contracts continue to pour into the Detroit area with automotive concerns getting the largest allotments. The total since Jan. 1 now exceeds the billion-dollar mark. Included among the more recent contracts are: Chevrolet, aircraft engines and spare parts, $112 million; Fisher Body, B-29 component parts, $94 million; Chrysler, B-29 parts, $33 million, trucks, $17 million, 40 mm gun barrel assemblies, $1.6 million; Ford, aircraft spare parts, $13 million, aircraft generators, $1.9 million; Detroit Diesel, medium tanks, $5.5 million; Graham-Paige, spare parts for landing craft, $5 million.

Although the labor supply in Detroit is about in balance at the moment, there are indications of a general tightening up, due to the increases in war contracts. Most automotive manufacturers' employment rolls have been down since last fall considerably under the levels of a year ago. This was due to running out of some contracts and smoothing out of production schedules. However, with the pressure for more output increasing, payrolls are expected to climb again. A particular shortage exists in the highly skilled classifications. The recent heavy increases in the artillery and mortar ammunition and bomb programs, for example, has brought on a shortage of set-up men in the screw machine products industry. Although programs requiring automatic screw machine products have practically doubled, the industry is producing at only 60 per cent of capacity because of the shortage of set-up men. The situation is further gummed up by the three to four year training period required and the fact that many trained set-up men are of draft age.

WPB reports that placing of new contracts with main contractors is not much of a problem, but finding smaller firms to take on sub-contracts is much more difficult. Accordingly, smaller plants have been asked to notify SWPC if they are threatened with shutdowns because of lack of work. Also, WPB has asked the Army not to sponsor any new construction or expansion of facilities in tight labor areas so that work may be canalized into smaller plants where labor is more plentiful.

WPB is starting to realize that it may have set its sights too high in the truck program. Total deliveries of heavy-heavy and light-heavy trucks during the first half of February were under those for the same period in January. Although a new program to expand facilities now is under way, goals may be lowered soon to more realistic levels until new facilities can be brought into production.


YEAR after YEAR after YEAR
Long Life
The life of a Sleeve Bearing is figured in years . . . not months. It is not unusual for us to learn of instances where Johnson Sleeve Bearings have been in continuous operation for fifteen . . . twenty . . . twenty-five years. And still delivering efficient performance.
There are several reasons why these records are possible. For instance, every Johnson bearing is made from the highest quality metal available. Every manufacturing operation is laboratory controlled. Johnson bearings are "tailor-made" to suit the application . . . to meet the operating conditions. Sleeve bearings are simple in construction . . . no moving parts within the bearing to fail.
Helping manufacturers to build real service into their product is a welcome assignment for Johnson Bronze. Simply call in a Johnson Engineer. Permit him to study your applications. Provide him with adequate information . . . speeds . . . loads . . . shock . . . or other operating conditions. He will give you the right solutions . . . based on facts . . . free from prejudice. Manufacturers giving thought to their postwar product will do well to consult with Johnson Bronze now.
JOHNSON BRONZE CO.
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BRONZE

Some Cases for Steel as a Material

(Continued from page 96)

the considerations of welded, press-formed alloy steel compared with cast magnesium construction are: Weight is equal for welded, press-formed alloy steel; steel construction is stronger and is stiff enough for the functional service; steel construction is less easily damaged, is field repairable and shop reclaimable; and steel construction is simpler, cheaper and quicker to produce.

Another group of equally interesting cases of steel as a material are those comparing the use of different fabricating processes but with the same material such as welded, press-formed steel and forged bolted-steel constructions. These cases are not as spectacular or as controversial as the case just reviewed, or as cases involving different materials using either the same or different manufacturing processes.

The several selected landing-gear, redesign cases proved welded, press-formed alloy steel construction offered many advantages over forged and bolted alloy-steel construction. According to Jerome S. Hunsaker, National Advisory Committee for Aeronautics, the size of planes will be strictly limited by the economics of larger landing fields, engines (including propellers) and landing gear—the latter especially serious for land planes. Therefore, these landing-gear cases may be important in revealing a design-development trend for critically-stressed members. For example, by redesigning the truss of the C-47 landing gear of the Douglas cargo plane, with welded, press-formed alloy steel, considerable weight was saved and a difficult production problem circumvented. Two large, long and thin alloy steel forgings were selected initially as the most suitable construction for the principal truss members. This forged design might have proved to be the final one except for a number of problems that arose during production. Large drop-hammer facilities for forging these members were limited. It was not practical to produce these forgings by expensive milling. Because of the size and shape, forging die breakage and scrap developed with the result that deliveries were unreliable. Large milling machine facilities for web-milling were also limited which meant new equipment or tying up machines that could otherwise be better utilized.

The welded design, produced by assembling simple, press-formed steel-strut members of the same alloy, overcame all of these difficulties. The necessity for machine work was reduced to a minimum by forming the pieces essentially to size and accurately assembling pieces of welding in fixtures. Increases in production did not require expensive new equipment while

the breakage of dies was avoided substituting press-forming for forg A press-formed type of strut, of si lar design could easily be made la and stronger without difficulty; would not be true of the forging p ess. Savings of critical-alloy, ro material were not only important fr a shortage standpoint, but from savings possible in the cost of terials.

The evolution of the B-24 bom landing-gear half-fork is likewise teresting in that several, low-al steel forgings, together with a b alloy-steel-tube combination, were placed by two press-formed halves the same type low-alloy steel materi an upper sleeve, an axle and some h —all assembled by welding to form composite structure. Some savings rough weight of alloy material sulted, together with improvements strength, with but slight increases finished weight. The important fac was the elimination of the need additional forging and machine equ ment to effect half-fork delivery at time required. Axles of both seaml tube and centrifugal castings have be used with only a slight advantage weight tolerance, favoring the form By redesigning for the welding a press-forming processes, a practi and economical construction is obtain

At the time of initially designing B-29 main landing gear, and whe members of greatest practical streng were desired, the designer selected forged alloy steel and bolted type trunnion. Before this original desi was adopted for production, the ge eral problem was presented for re sign consideration where analy showed that a press-formed, low-all welded-steel structure would bett serve the purposes. Not only was t finished weight of each of two tru nions reduced 72 lb., or 33 per cent, b the rough, alloy-material saving w 450 lb. per trunnion, or 64 per ce The substitution of welding for bolti in assembly accounted for much of th weight reduction, because of great strength and stiffness of the integrall combined, welded trunnion and tub members.

Weight Comparisons of Alloy-Steel Versu Cast-Magnesium Frames (for B-29 Bomber Nose Construction)

Part	Weight i Steel (Lb
Rim	14.95
Upper Ribs	6.56
Side Ribs	4.30
Outer Ring	2.51
Inner Ring	1.44
Lower Ribs	4.41
Channel	2.72
Gusset Plate	0.16
Bracket	2.00
Total Weight	39.05
Total weight of welded, press-formed, steel frame (from above)	39.05
Weight-saving with shorter-bolt construction	2.00
Net weight of steel frame (less bolt saving)	37.05
Weight of cast-magnesium frame	39.50

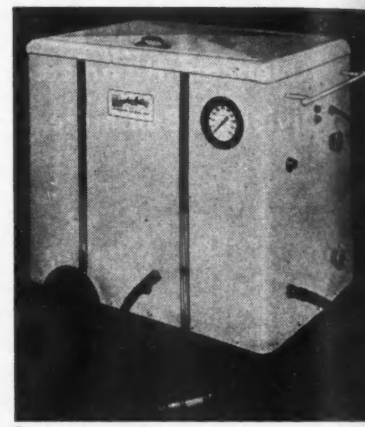
New Products

(*Continued from page* 132)

the shaft and using an end shaft rotary air seal; second, by using a special shaft-a-round, or mid-shaft rotary air seal.

High-Pressure Cleaning and Degreasing Unit

The Hydra Lectric Hy-Pressure degreasing and cleaning unit designed and manufactured by the Hydra Lectric Products Corp., Indianapolis, Ind., provides a hot water-borne, grease-emulsifying solution at high-pressure in ample volume to rapidly degrease, clean and flush the job in a single operation. Portability, in combination with this cleaning method, makes the unit useful on a wide variety of jobs such as cleaning



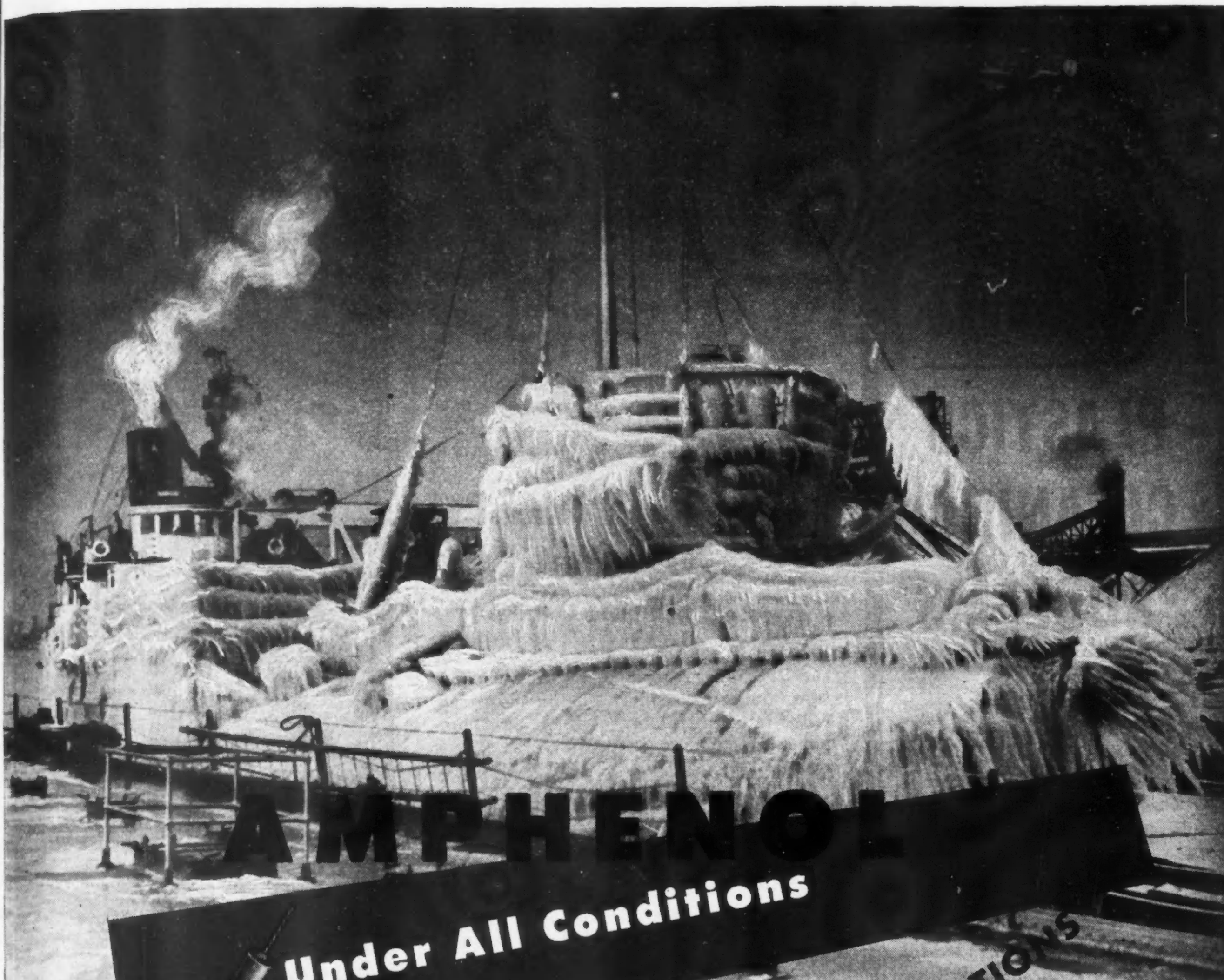
Hydra Lectric degreasing and cleaning unit

of aircraft exteriors prior to waxing, line maintenance cleaning of engines, cleaning engines prior to tear-down, pre-cleaning of parts after engine teardown, cleaning of floors, test cells, automotive equipment, and general plant maintenance. The Hydra Lectric Unit delivers a grease emulsifying solution (either hot or cold) in volume of 5 gpm at 300 psi pressure at the nozzle. For heavily dirt-encrusted and carbonized surfaces the unit is designed to apply a pre-soak solvent oil which quickly loosens up hard-packed layers of grease and dirt preparatory to hy-pressure cleaning.

Pressure-Time Curves Indicated by New Device

Electro Products Laboratories, Inc., Chicago, Ill., has placed on the market a new product known as the Pressuregraph. It is claimed by the manufacturer that this new electronic device will indicate, in linear response on the screen of a cathode ray oscillograph, the pressure-time curve of any internal combustion engine, pump, airline, or any other enclosed pressure system where pressure measurements are desired. The Pressuregraph measures

(*Turn to page 154, please*)



AMPHENOL

Under All Conditions

CONTRIBUTES TO RELIABLE COMMUNICATIONS

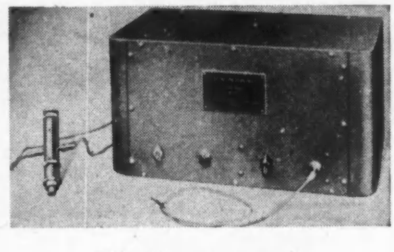
Man's isolation under adverse conditions has ended with recent radio developments which overcome the trying conditions of air and sea transportation. This means rising above all conditions of interference. Among the things that have made this possible is Amphenol *current transmission equipment* that will carry the high frequencies without appreciable loss.

The name "Amphenol" on high frequency cables means the best of polyethylene insulated cable—cable that is sold under affidavit of exacting tests and inspections. "Amphenol" on low-loss connectors means the minimum of loss in tight fitting, secure holding connections. On both it means transmission equipment that will do its part toward providing the clearest possible transmission and reception of communications even under adverse conditions.

AMERICAN PHENOLIC CORPORATION
Chicago 50, Illinois
In Canada—Amphenol, Limited—Toronto

Depend upon AMPHENOL *Quality*

U.H.F. Cables and Connectors • Connectors (A-N, British) • Conduit • Cable Assemblies • Radio Parts • Plastics for Industry.



The Pressuregraph

either static or dynamic pressures. It is stated to have been successfully applied to 2-cycle engines to show pressure-time-curve of main cylinder or crankcase and also to have been used on C. F. R. aviation fuel test engines for measurement of pressure-time-curve.

In operation, the pickup section of the Pressuregraph is inserted in the cylinder, chamber or airline, etc., to be pressure measured. The pickup response is transmitted, after amplification, to the screen of a cathode ray oscillograph.

Additional advantages claimed for the Pressuregraph are simplified operation, only one control being required, with one initial adjustment to compensate for temperature effects.

Non-Thermoplastic Rubber Cement

A new rubber cement, named Plastilock 500, a non-thermoplastic, water and aromatic oil-resistant adhesive for bonding metals, wood, plastics and ceramic material to themselves or to each other, is announced by the B. F. Goodrich Company, Akron, Ohio. The company claims it provides superior bonding qualities in any of its applications, and in some cases can be used in place of rivets or screws.

In using Plastilock 500 the company advises that best results are gained by applying heat with pressure, although heating alone will give some degree of adhesion. Purpose of the pressure is to obtain good surface contact. The bond strength varies with the materials being adhered.

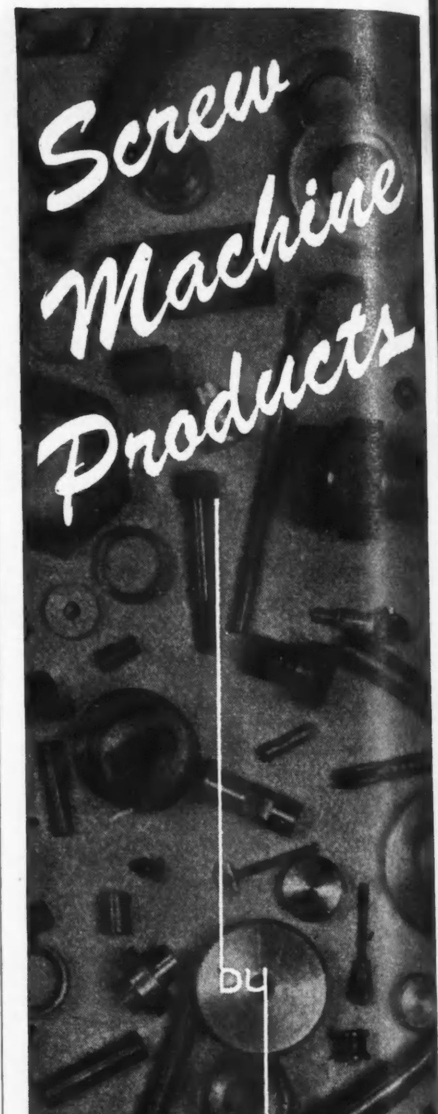
The new adhesive, used for metal-to-metal bonding, is said to have shown a shear strength of 3250 lb per sq in. and tension strengths of 4000 lb per sq in.

Dual-Purpose Diamond Wheel

A dual-purpose Super Cut zurium bonded diamond wheel which is two diamond wheels in one, for rough grinding and fine finishing of cutting tools, has been developed by Industrial Abrasives, Inc., Chicago, Ill. The maker states that this is the first time that it has been possible to make such diamond wheels. They are made under Industrial Abrasives' process of securely locking the diamonds in the matrix, layer upon layer.

Of the two separate grinding surfaces, the outer 7 deg beveled surface

(Turn to page 156, please)



10,000 THUNDERBOLTS

10 GRAND

...a Significant Number

The flight line ground crew that handled the 10,000th P-47 and gave the milestone plane its final overhauling.

The figure "10,000" has an established significance in the annals of the air. When it became known not many years back that Germany had that number of modern war planes, the news was definitely disturbing in many lands. It meant, at the time, dominance in the air should the much-appeased Hitler choose to take the warpath. In those times no one would have ventured to predict what American engineering genius and mass production have since accomplished.

Already the 10,000 mark has been passed in the production of a single American-built plane—the Thunderbolt. Largest of fighter planes, with unmatched fire power, and created to do things no airplane had ever done before, the Thunderbolt has created its own demand by superlative performance on many fighting fronts. It takes 20,000 man-hours to build a Thunderbolt, but Republic and its subcontractors have come through in the American way.

We have kept pace with the production of the Thunderbolt and other outstanding planes by delivering — on time — large quantities of tough drop forgings for the parts which must withstand tensional, torsional and compression stresses. Airframe drop forgings constitute our entire production.

The inquiries of plane and engine builders are solicited.

Member of the A.C.C.A.

Kropp Forge Aviation Co.

Engineering Representatives in Principal Cities

Division of The Kropp Forge Company

5301 W. ROOSEVELT ROAD, CHICAGO (50)

contains layers of coarse diamonds whereas the inner flat surface is built up of fine diamonds.

Heavier Cord Used in Military Tires

The Firestone Tire and Rubber Co., Akron, Ohio, is now using heavier rayon cord in the construction of military tires.

Tires built with fabric made from the heavier cord are stronger, although they contain approximately 25 per cent fewer plies. This reduction in plies has speeded production by cutting the time required to build tires. The time saving varies with the different sizes but is substantial in all cases.

The new cord is .034 in. thick—about .010 in. thicker than rayon used previously—and has a tensile strength of 34 lb compared with 16½ lb for the lighter cord.

Self-Anchoring Pins

The Driv-Lok Pin Company, Chicago, offers a complete line of standard and special self-anchoring, vibration-proof pins, which are designed to replace taper pins, keys, cotter pins, set screws, rivets, etc. These pins, which are pressed or driven into standard drilled holes, have four flutes on the surface parallel to the axis. The length and position of the flute can be controlled accurately, so that fully or partially grooved pins are available. Fully grooved pins have a pilot at one end so that the pin can be easily inserted.

Horner Heads Surplus Advisory Committee

H. M. Horner, president of United Aircraft Corporation, has been elected chairman and J. Carlton Ward, Jr., president of Fairchild Engine and Airplane Corporation, vice-chairman of a newly formed Surplus Advisory Committee for the Eastern Region of the Aircraft Manufacturers Council of the Aeronautical Chamber of Commerce of America.

New Products for Aircraft

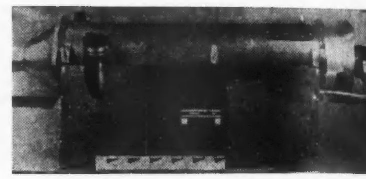
(*Continued from page* 102)

side air pressure is needed. A large hand pump that is built into the stand gives the pressure needed for the flow of fuel. The carburetor mounting bracket facilitates quick leveling of the carburetor.

A screen filter in the fuel return to tank can be quickly removed for cleaning. The pressure gage is of aircraft type, reading 0 to 15 lb pressure.

Portable Aircraft Heater

Designed for the comfort of men carried in hospital airships, Surface Combustion, Toledo, Ohio, announces a portable "Janitrol" aircraft heater which also is applicable to heating helicopters, preheating plane engines and for other uses. The portable feature is entirely



Janitrol aircraft heater

new to aircraft heating, according to the manufacturer.

The new heater is completely self-contained except for motive power, weighs less than 38 lb and has a heat output of 40,000 Btu per hour. The fact that no outside air is needed to operate the heater is what makes it especially suitable for helicopters. No motion of the ship is necessary for the heater's operation, from ground level to its 15,000-ft ceiling.

Fire Detector for Use on Aircraft

The Wilcolator Co., Newark, N. J., has brought out an improved fire detector for use on aircraft. This air-

(*Turn to page* 160, *please*)

Pesco's Pump Problem...

SOLVED BY PRECISION BUILT SIRVENE

Pioneers in the science of compounding custom-built elastomers, Chicago Rawhide chemical engineers can fill performance specifications previously considered impossible. For example, check this typical case history of a problem solved by a special Sirvene formula: THE PRODUCT: A diaphragm for the improved Pesco fuel pump which now feeds America's leading fighting planes. THE REQUIREMENTS: Maintain dimensional stability and resilience in contact with oil and gasoline, remain flexible in extreme heat and cold, give full suction in emergencies, minimize time lost for replacement. THE RESULT: For several years now, a Sirvene diaphragm has delivered precision performance with endurance four times as long as previous products.

Why does Sirvene produce such exceptional results? Because Chicago Rawhide engineers have an unparalleled backlog of research and practical experience, because oil-resistant elastomers only are used, because a special Sirvene formula is developed to meet each problem, because production is under constant and rigid laboratory control. When you need a pliable part to operate under exceptional service conditions, investigate the advantages of Sirvene.

SINCE 1878

...The Chicago Rawhide Manufacturing Co. has specialized in the manufacture of Sirvis leather products for mechanical application. In 1929, Chicago Rawhide chemical engineers began a program of research, study and experimentation to develop elastomers which would operate efficiently under exceptional conditions. Sirvene was the result, and commercial production was begun in 1935. Sirvene was then, and has continued to be, the leader in its specialized field.

SIRVENE

THE *SCIENTIFIC* COMPOUNDED ELASTOMER

A Product of the Synthetic Rubber Division

CHICAGO RAWHIDE MANUFACTURING CO.

1310 Elston Avenue — Chicago 22, Illinois

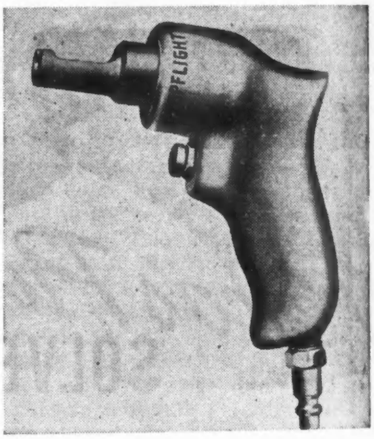
New York · Philadelphia · Detroit · Los Angeles · Cleveland · Boston
Pittsburgh · San Francisco · Cincinnati · Portland · Syracuse · Peoria

craft fire detector is said to combine the advantages of the "rate-of-rise" principle for fast detection of fires plus operation at a temperature beyond the normal ambients that are encountered to also indicate dangerously high temperatures which may eventually cause damage or a fire. The speed of fire detection with the Wilcolator "rate-of-rise" fire detector is the same whether the airplane is operating under subzero conditions or at a high atmospheric temperature.

Hose for Oil and Coolant Lines

A new type of hose, designed especially for connections on oil and coolant lines on Army plane engines, has been added to the line of the Goodyear Tire & Rubber Co., Akron, Ohio. Said to be the first of its kind ever produced, the hose is compounded to withstand severe temperatures, and has great strength and flexibility. The hose is being produced in eleven sizes, and has already been flight tested and approved by the Army Air Forces.

Pneumatically Operated Skin Fastener Plier



This Topflight skin fastener plier is said to provide an improved method of installing and removing skin fasteners such as Cleco, F & H Monogram and others. This new pneumatically operated tool is being introduced by Topflight Tool Co., Towson, Md.


BORING MILL
Tools
Save setup and production time by making your Boring Mills more versatile . . . Scully-Jones Standard Boring Mill Tools and Adapters can be interchanged or used independently on several kinds of machines. Check the following list to see how these tools will permit more operations being performed on your equipment. Consult us for further information, recommendations and prompt quotations.
BORING BARS
ADAPTERS FOR END MILLS
ARBORS FOR SHELL END MILLS
COLLET CHUCK ADAPTERS
COLLETS AND COLLET HOLDERS
FACE MILL ADAPTERS
CENTERING ARBORS
FACE PLATE CONVERSION ADAPTERS
SPINDLE TYPE CONVERSION ADAPTERS
EXTENSION SOCKETS
REDUCING SLEEVES
TOOL BITS— SQUARE OR ROUND TYPE
HEAVY DUTY FLOATING HOLDERS
MAGIC TYPE QUICK CHANGE CHUCKS
QUICK CHANGE FLOATING HOLDERS
RECESSING TOOLS
Scully-Jones
AND COMPANY
1901 SOUTH ROCKWELL STREET • CHICAGO 8, U. S. A.

Direction 3 WPB-293

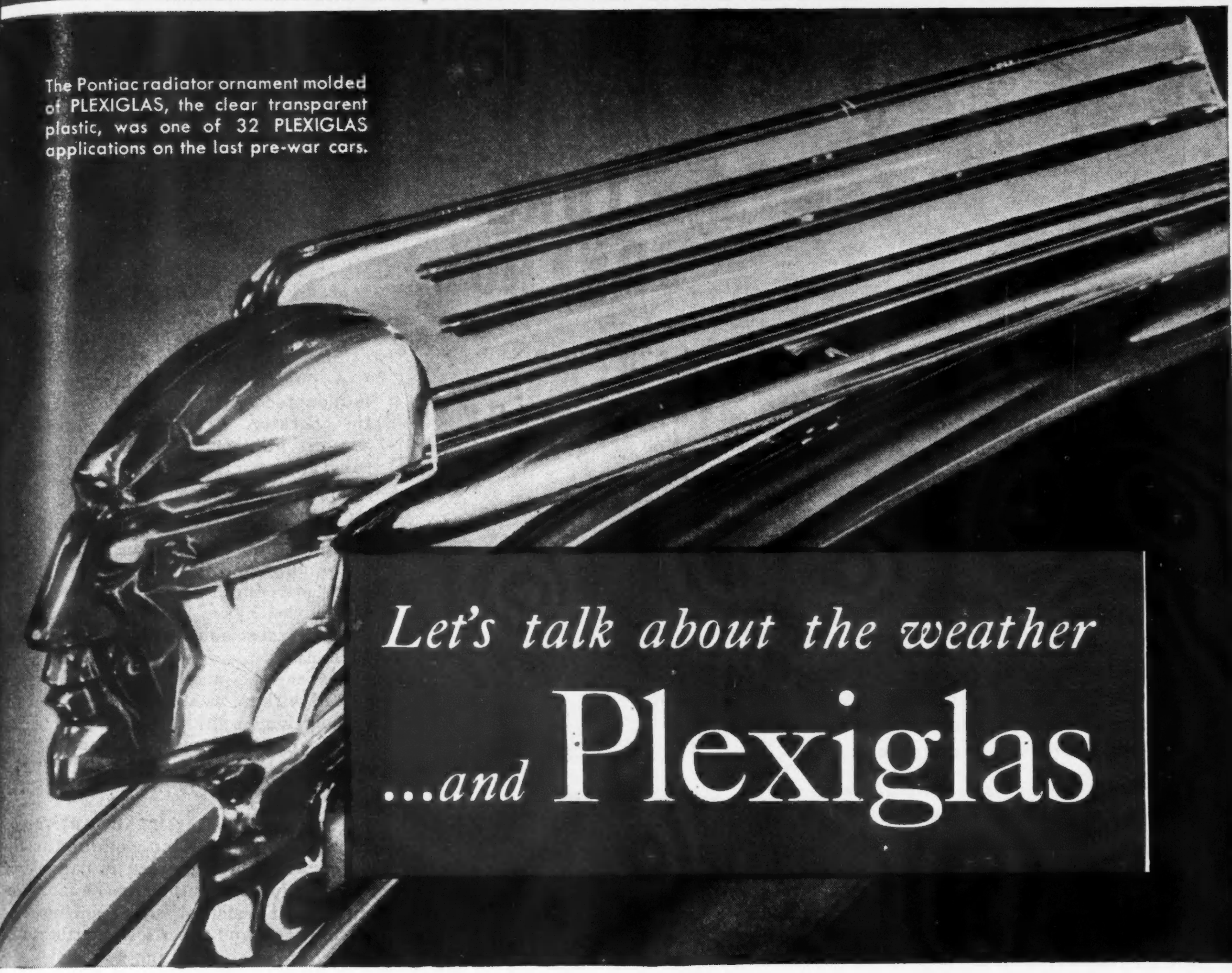
(*Continued from page 92*)

oil and water pumps, gears and shafts, small gray iron castings.

In action, when a critical shortage is discovered or where a shortage is anticipated, EPCO undertakes a national survey to determine the minimum requirements for all claimants, including civilian agencies. Next it studies the facilities and productionability of known suppliers. In an effort to seek quick relief, EPCO attempts to find going concerns capable of producing such parts without loss of time. If that expedient fails, steps are taken to increase the production capacity of known suppliers. The Hatfield Committee is committed in such instances to speed the way for quick approval of facilities proposals; for improving the manpower situation; and in general to take such steps as are necessary to build up capacity for producing parts and pieces.

Manufacturers are invited to study their own situation and to make recommendations directly to the Hatfield Committee or to EPCO as to what can be done for them that would increase the flow of needed parts for engines. It is promised that such proposals will be given immediate attention. By acting promptly the manufacturer will prevent drastic scheduling procedures which might easily upset his planning and create a re-alignment of his customers.

Despite the condition of the sales order board of a parts producer, the demands for parts will undoubtedly continue to increase. The Navy, in particular, will be a pressing customer long after V-E Day. Parts makers are warned that steps should be taken to assure themselves that sufficient capacity exists in their plants to produce these necessary parts even when they begin to reconvert for civilian production. In some cases the parts requirements for the armed services which remain on the books after reconversion may be instrumental in blocking full speed ahead for civilian production.



The Pontiac radiator ornament molded of PLEXIGLAS, the clear transparent plastic, was one of 32 PLEXIGLAS applications on the last pre-war cars.

Let's talk about the weather ...*and* Plexiglas

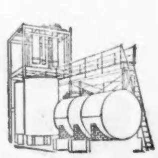
RAIN expected? Snow or sleet predicted? Heat wave coming?... It won't matter. The PLEXIGLAS radiator ornaments that enrich so many pre-war cars will continue to sparkle through all kinds of weather...just as they've been doing for the last several years. No sign of discoloration or cloudiness mars their crystal-like transparency.

To automotive designers and manufacturers, the permanent transparency of PLEXIGLAS— its strength, shatterproofness, light weight and ease of molding— are a familiar story. In its gem-like *beauty* and remarkable design possibilities, lie the answer—clear as PLEXIGLAS itself—to one problem of post-war modernization.

Lustrous PLEXIGLAS radiator ornaments, horn buttons, instrument panels and dials, escutcheons, tail light name plates and scores of other applications in new and interesting designs will improve car appearance and impart those modern touches anticipated by buyers.

DETROIT REPRESENTATIVE: W. E. Biggers
619 Fisher Building—Madison 1500

PLEXIGLAS IS JUST ONE of the many types of products developed by Rohm & Haas research. The varied fields this company serves with a diversified line of chemicals range from aircraft (plastics) to agriculture (insecticides and fungicides), textiles (reducing agents and fabric finishes), enamelware (porcelain opacifiers), and leather (synthetic tanning materials and finishes).



Only Rohm & Haas makes PLEXIGLAS

PLEXIGLAS is the trade-mark, Reg. U. S. Pat. Off., for the acrylic resin thermoplastic sheets and molding powders manufactured by Rohm & Haas Company.

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA, PA.

Manufacturers of Chemicals including Plastics . . . Synthetic Insecticides . . . Fungicides . . . Enzymes . . . Chemicals for the Leather, Textile and other Industries

Production Equipment

(Continued from page 88)

position are located at opposite ends of a long main base, from the middle of which an auxiliary base extends to the rear to accommodate the third horizontal unit. The fourth unit, which operates vertically, is mounted on a column that straddles the rear unit.

A quick-action work-holding fixture is mounted in a convenient position for the operator. Brackets are provided to support guide bars to maintain necessary alignment.

RESISTANCE to wear is said to be the outstanding characteristic of sapphire plug and ring gages which are being introduced by the Elgin National Watch Co., Elgin, Ill. Because sapphire is the hardest substance on the mineral hardness scale, next to the diamond, gages can be made to the exact size needed with no wear allowance required. In addition, sapphire is not affected by chemicals ordinarily encountered in gaging, and is not subject to burring.

O'NEIL-IRWIN MANUFACTURING CO., Minneapolis, Minn., offers the Di-Acro radius brake which is capable of forming duraluminum, chrome molybdenum, rust-resistant and spring-tempered alloys, and other low ductile mate-

(Turn to page 166, please)

Di-Acro radius brake


GAIRING DETROIT
memo to the
metal working
Industries
When you measure productive value in terms of unit cost, these Gairing heavy duty inserted blade cutter heads are symbols of metal working economy.
Bodies are of heat treated chrome vanadium steel. The Gairing method of mounting recommended types of inserted blades assures quick adjustment and renewability; provides for three-way strain: shock load, radial pressure and thrust. Chip egress and cutting clearances are engineered to meet specific conditions.
These four Gairing cutters are typical of thousands in use throughout the metal working industries. The names of the firms who purchased them are an index of industrial America.
Let us assist you.
THE GAIRING TOOL COMPANY, DETROIT 32, MICH.
GAIRING
MANUFACTURERS OF STANDARD AND SPECIAL INSERTED BLADE CUTTING TOOLS

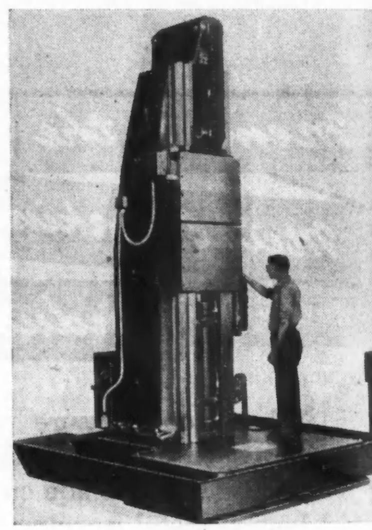
rials essential in the fabrication of aircraft.

This precision radius brake is said to eliminate the possibility of fracture or disintegration developing at the line of forming, while working such materials.

The radii obtainable with this unit are in accordance with the predetermined standards recommended by the United States Army Air Corps for aircraft construction.

Case hardened and spring tempered materials that must be formed after heat treating can also be worked to accurate dimensions with the Di-Acro radius brake.

THE 924 vertical drilling, boring and facing machine, manufactured by W. F. and John Barnes Co., Rockford, Ill., can be adapted to many types of high-production jobs requiring up to 60 hp and 50,000 lb thrust. Design and construction features make it suitable for



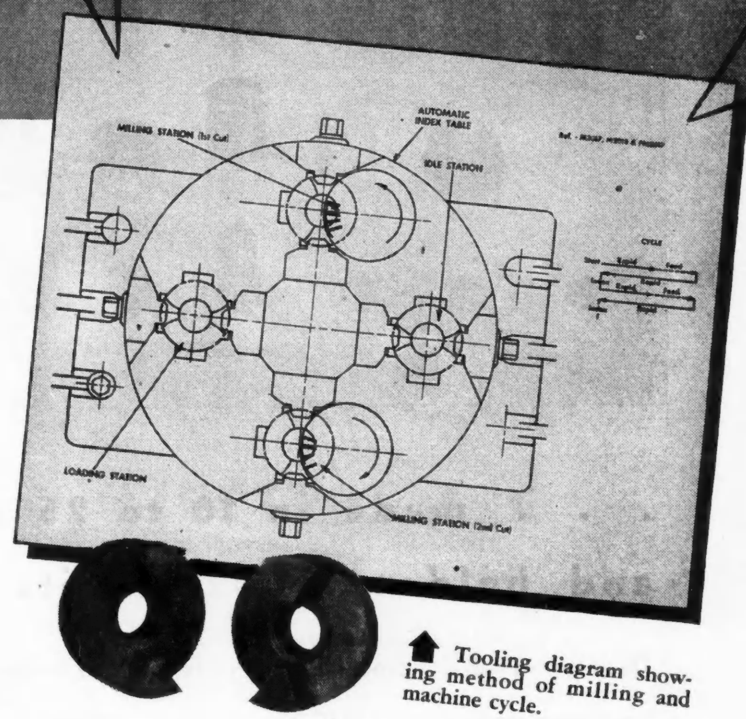
924 vertical drilling, boring and facing machine made by W. F. and John Barnes Co.

mass production drilling, boring, facing and reaming, especially on those jobs requiring wide-area heads. Unusually slow feeds are obtainable for heavy fac-

(*Turn to page* 168, *please*)

A "STRICTLY SPECIAL" MILLING JOB

. . . . HANDLED ON MODIFIED STANDARD SUNDSTRAND RIGIDMIL



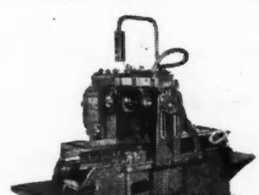
Tooling diagram showing method of milling and machine cycle.

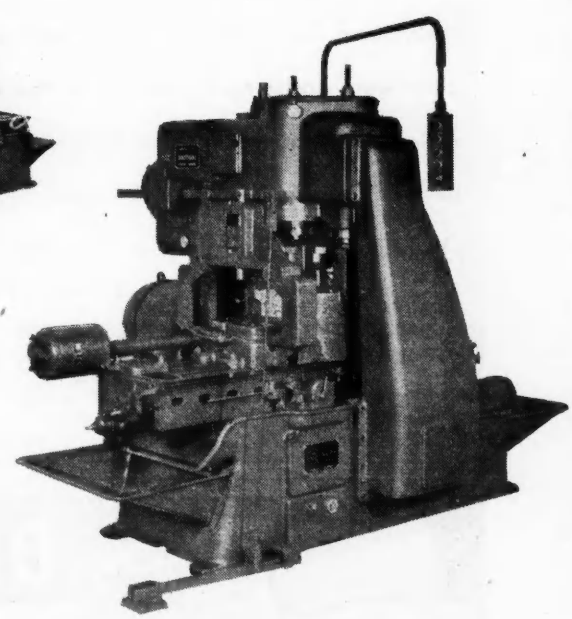
Designed to accommodate a wide variety of special heads and tooling Sundstrand *Standard* Rigidmils are often used to solve special milling production problems.

Here's how the Houde Engineering Corporation uses a Sundstrand Fluid Screw Rigidmil on a special milling problem. The shock absorber abutment flange requires milling at high production and to close limits. The Standard Rigidmil* has been provided with a special head having two vertical spindles and a special outboard brace. A standard Sundstrand automatic index base with four special work holding fixtures is mounted on the machine table. Operations consist of milling in stations No. 2 and No. 4, see operation drawing.

PRODUCTION INCREASED 40%

In addition to increasing ease of operation and accuracy, production has been increased 40% over the former method. The foot operated lever roughly positions the part prior to clamping—dial indicators facilitate speedy, accurate setting of the cutters.





• Above, Standard Rigidmil. Right, same machine supplied with standard index base and modified to suit special milling job.

DIMENSIONS HELD TO .0002" CONSISTENTLY

Application of the standard Sundstrand Automatic Index Base eliminates the need for re-locating the work between operations. Consequently both sides of the flange are held absolutely flat, parallel with each other and within a relative height of .0002".

HOW SUNDSTRAND ENGINEERED PRODUCTION WILL GIVE YOU ECONOMICAL MILLING

In addition to having designed a wide range of Standard Rigidmils which are easily rearranged to accommodate special milling jobs, our engineers have designed countless special machines for all types of production milling jobs. Call on them without obligation. Write for these descriptive machine bulletins today. Ask for bulletin 234.

ARMY E NAVY

SUNDSTRAND MACHINE TOOL CO. • ROCKFORD ILLINOIS U.S.A.

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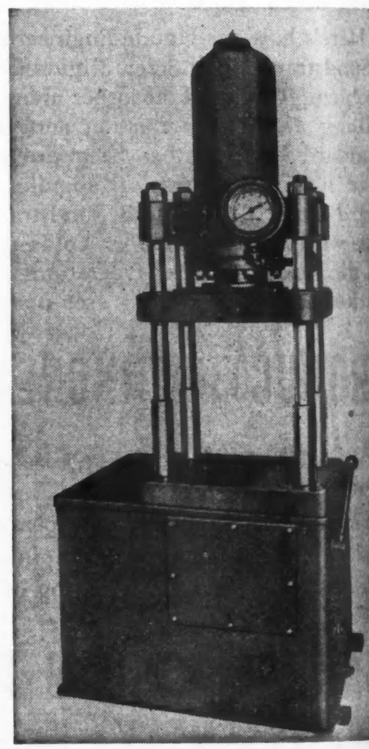
ing work by an adjustment on the hy draulic unit mounted on the side of th column. The column casting with 24-in ways carries the head saddle and hea which are counterbalanced by easily accessible weights. The control ba with adjustable dogs for governing th head travel, and the way lubricator, ar mounted in the head saddle.

A 25-TON, self-contained, plain hydrau lic press built by The Watson-Still man Co., Roselle, N. J., is a compac machine with a wide range of applica tion for general utility work. It is o four-rod construction with "moving down" ram and double-acting cylinder

Operating pressure is 1000 psi, strok is 10 in., platen is 15 in. x 15 in., and the daylight opening is 20 in. The cyl inder is 8 in. in diameter and the ram

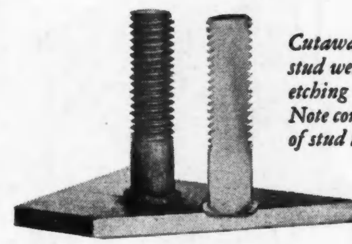
(*Turn to page* 170, *please*)



Watson-Stillman hydraulic press

Automatically end-weld studs!

- Complete fusion between stud and metal in ½ second . . . Saves time.
- No drilling holes or hand-welding bolts. Studs are pointed for accurate locating.
- One operator can weld more than 1000 studs per shift. Completely portable. Also available as a production jig.
- Thousands of guns now being used in more than 500 shipyards and industrial plants.

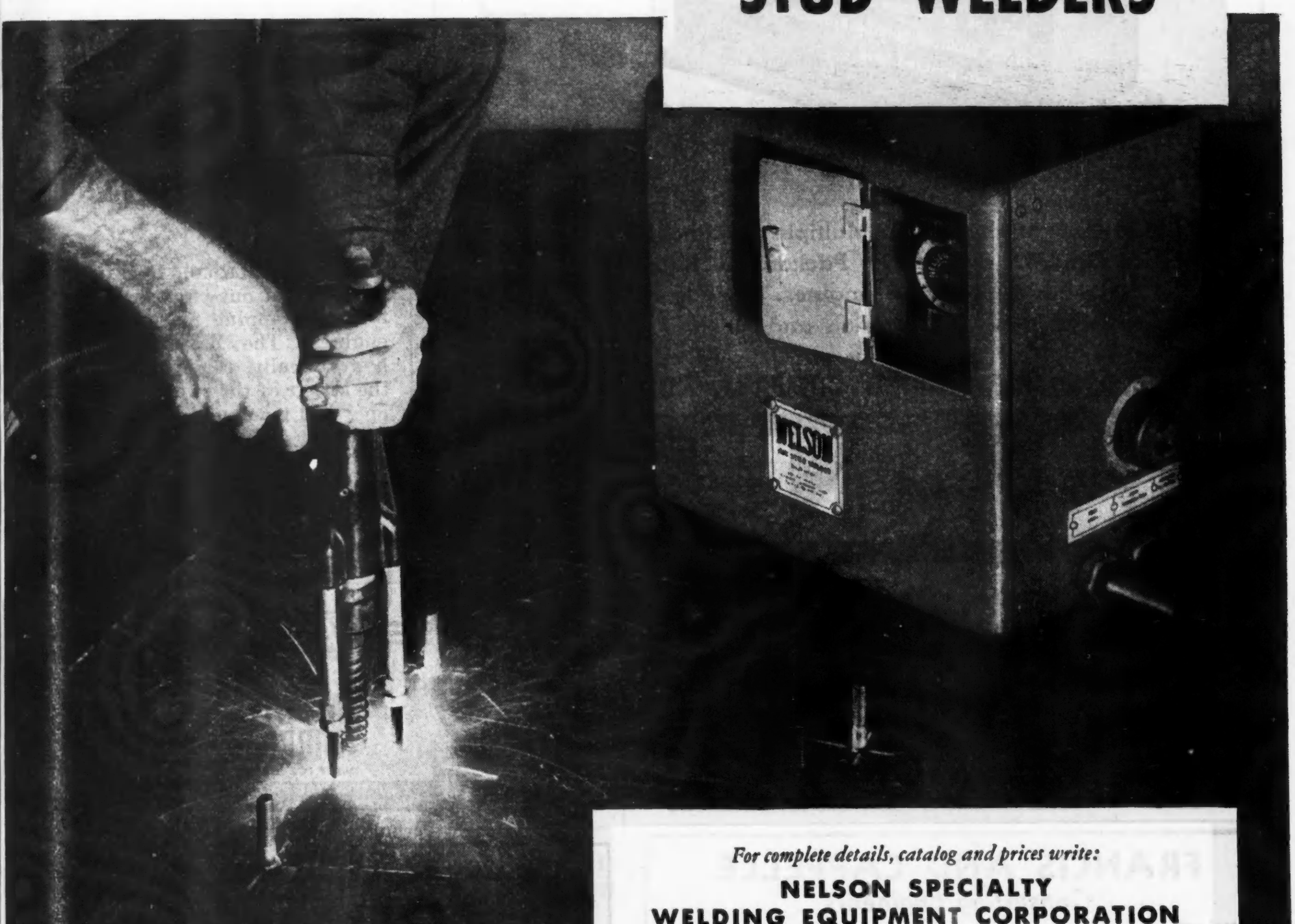


Cutaway view of stud weld after etching with Nital. Note complete fusion of stud to metal.

NELSON

ELECTRIC ARC

STUD WELDERS



End-welding a stud to metal plate.

For complete details, catalog and prices write:

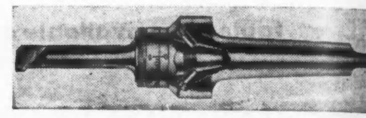
NELSON SPECIALTY
WELDING EQUIPMENT CORPORATION
Dept. AV, 440 Peralta Avenue, San Leandro, Calif.

Eastern Representative: Camden Stud Welding Corp.
Dept. 122, 1416 South 6th Street, Camden, N. J.

is 7¼ in. in diameter. Pressure is su plied by a high and low pressure va type radial pump direct driven by a hp motor. Four-way valve control operated by a single hand-lever to va load from 15 to 25 tons.

Operating speeds are: Advance, 1 in. per minute; pressing, 20 in. p minute; return, 114 in. per minute.

MICROMETRIC adjustment of the Dia Set boring tool, made by Sta Manufacturing & Construction C Franklin, Ohio, is accomplished throug an eccentric cone and socket. With th vernier set at 0-0, the quill is exact centered. As the vernier is turned, th quill is thrown off center through grad uations of .001 in. to a maximum 0.50 in. boring diameter. Since the b is held in the quill by a setscrew,



Dial-Set boring tool

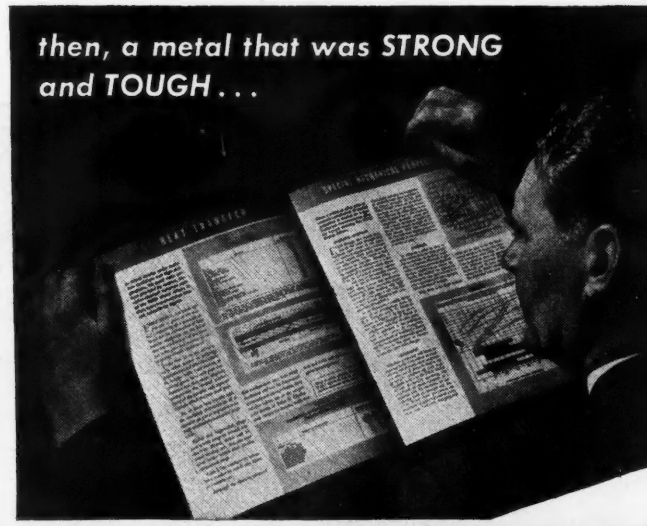
secondary increase in boring diamete can be effected by extending the bit.

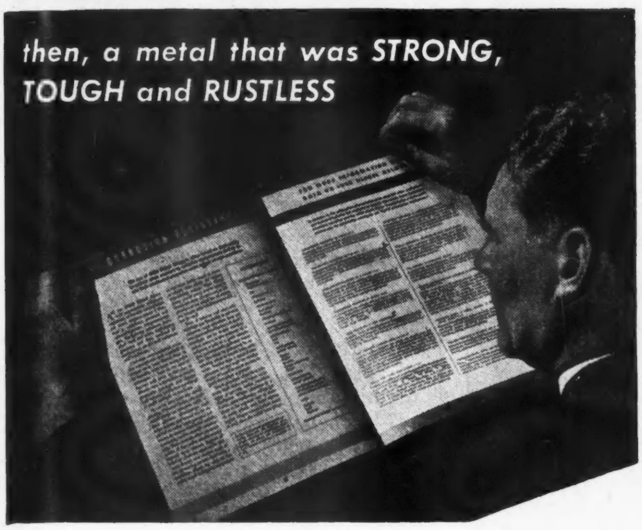
The holder—consisting of straight o tapered shank, socket, and scale—ac commodates a group of four or mor inserts, the latter consisting of cone vernier, quill, and bit. The "A" kit, fo example, comprises a holder and fou inserts. Standard round bits are used making replacements available from supply houses, although the manufac turer is prepared to furnish carbide diamond, and other special types of bits

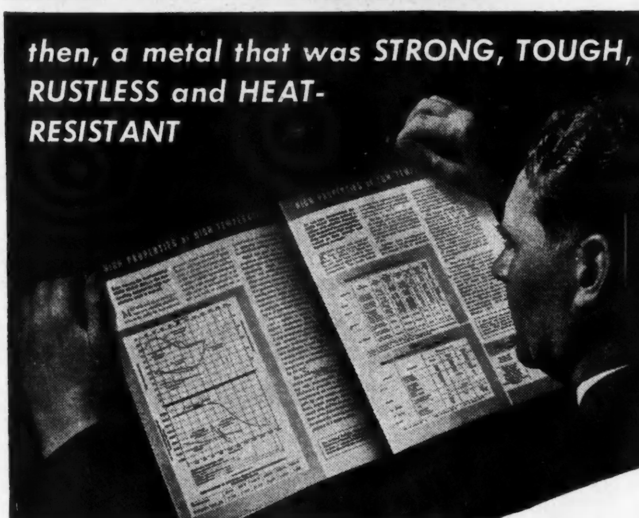
BARNES DRILL CO., Rockford, Ill., has brought out two new horizontal ps ton ring lapping machines for aircraf engines. The Barnesdril cabinet-typ hydraulically reciprocated machine i the larger of the two; the pneumatically operated machine is quite similar but i designed for bench use.

Both machines are designed to lap rings in sets and fitted to the specific cylinder in which they are to be in stalled in the engine. To this end the

(*Turn to page 172, please*)



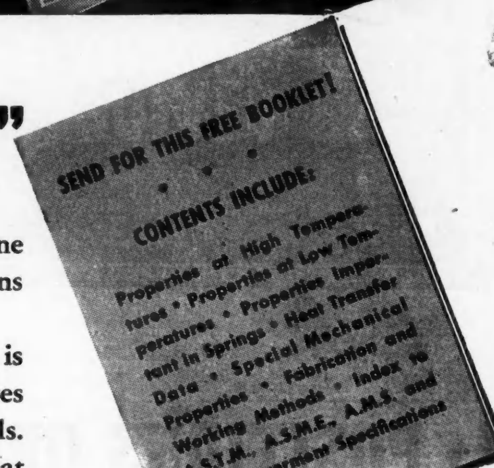




. . . and every time,

"SELECTED METALS for AIRCRAFT USES"

put him on the right track



PICKING THE RIGHT METAL isn't much of a problem if only one property has to be considered. But how often do aircraft applications demand only *one* feature of excellence?

Usually, three, four *or even more* properties are needed if a metal is to be adequate for a given function. Making a selection, then, involves careful evaluation of the *complete* set of properties of many metals.

And that's where this booklet can help you! For *here* you have at your fingertips one summary that discusses *all* the important properties and characteristics of eight metals whose unique *combination of properties* have solved many troublesome problems in the aircraft industry. Send for your copy today.

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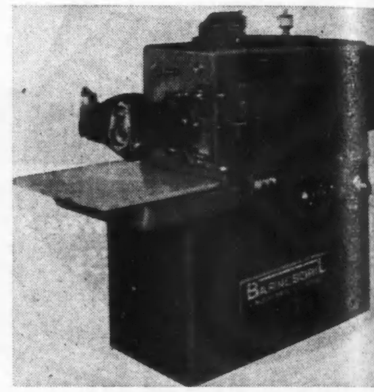
Sheet...Strip...Rod...Tubing...Castings...Wire...Welding Rods (Gas and Electric)

rings are mounted on a dummy piston. Rings are compressed and the radial cylinder barrel is placed on the piston, releasing rings to normal wall pressure. The cylinder is clamped in position as shown. A loose abrasive is used and the machine is equipped with mechanism to rotate the spindle (180 degrees in 12 in. of travel) on the forward stroke and to return without rotation. The machine also is equipped with automatie stroke timing mechanism. Adapter plates are used for holding various



Barnesdril cabinet type piston ring lapping machine

diameters of radial aircraft cylinder barrels. The cabinet machine has adjustable spindle stroke up to 12 in.

The bench type machine is similar to the hydraulically operated unit, but is smaller and lower in price. The adjustable stroke of the pneumatically operated spindle is from 2 in. to 12 in., and the reciprocation is adjustable from 25 to 120 strokes per minute, operating under 100 lb. air pressure per sq. in. Unit is equipped with stroke counter and automatic stop switch.

A REAMER holder for automatic screw machines, which permits the reamer to "float" in any manner necessary to line up with a drilled hole, is now in production in an assortment of sizes at the Green Mfg. Co., Rockford, Ill. The float principle in the Green reamer

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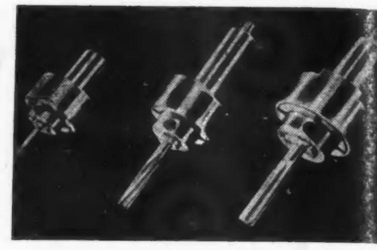

Green reamer holders

holder is based on two synthetic oil-resistant rubber rings. These allow free but controllable motion in any direction, including lateral as well as pivoted motion.

A hollow set screw fixes the position of the reamer and a spanner which adjusts a threaded compression screw sets the tightness of float. Both these adjustments can be made with the holder in working position in the machine.

Westinghouse Elevator Co. Creates Two Divisions

Ellis L. Spray, vice president and general manager of the Westinghouse Electric Elevator Company, has announced the creation of two separate divisions to carry on the work of the company, the Air Conditioning and the Elevator Divisions.

Ross Rathbun, formerly manager of air conditioning, has been appointed manager of the expanded Air Conditioning Division, which now includes the Precipitron; and Walker G. White, formerly sales manager, has been named manager of the Elevator Division. George F. Begoon, who for several years has directed commercial development of the Precipitron, has been named manager of the Precipitron Department of the Air Conditioning Division.

Advertising Note

The Luscombe Airplane Corporation of Trenton, N. J., has appointed the John Mather Lupton Company, New York City, as its advertising agency. Both aviation trade and general publications will be used in a program to be launched soon.

NTDMA Increases Membership

A group of leading drop forging die manufacturers voted at a meeting in Detroit recently to affiliate themselves with the National Tool and Die Manufacturers Association, according to an announcement by George S. Eaton, of Cleveland, Executive Secretary of NTDMA. While a number of these shops have been in the NTDMA for some time, the majority was as yet unaffiliated.

A Forging Die Section of the NTDMA is planned to deal with any special activities which these manufacturers want handled. For the most part, however, their problems and interests will be identical with those of the other contract shops producing special tooling equipment—for example, in such matters as government regulations and controls, public relations, selective service deferments, excess profits taxes, repricing, among others.

Mosquito Bomber Sets New Speed Record

Setting a new record for trans-atlantic flight to Europe, a Canadian-built Mosquito bomber recently flew from Goose Bay, Labrador, to Prestwick, Scotland, in six hours, eight minutes. The distance between these two points is 2300 statute miles and the average ground speed was 376 mph.